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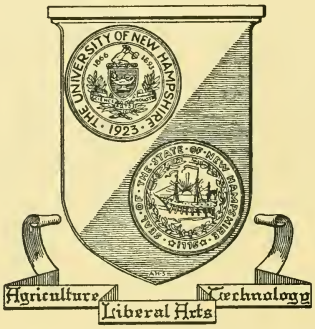

The University
of
New Hampshire

Report of the

Director of the New Hampshire Agricultural Experiment Station

STATION BULLETIN 394 MARCH 1952

UNIVERSITY OF NEW HAMPSHIRE

DURHAM, N. H.

FOREWORD

This publication represents a summary of the progress attained by the Agricultural Experiment Station at the University of New Hampshire, and will be recorded as the 62nd and 63rd in the series of annual reports. No separate bulletin was published for the fiscal year July 1, 1949 to June 30, 1950, and therefore this bulletin covers the two-year period beginning July 1, 1949 and ending June 30, 1951.

The brief summaries were prepared by the respective project leaders. The nature of the work represents both basic and applied research. The latter is of a kind that has immediate application to production and is intended as a means toward greater efficiency of operations on farms. The ultimate goal is an adequate food supply at reasonable cost. This involves better plants and animals, more efficient machines, more effective control of diseases and insects, and more effective farm management.

The rooster featured on the cover of this bulletin is a *New Hampshire*, the predominating breed in America. It was originated in this state. Moreover, New Hampshires are the foundation of the state's largest agricultural industry.

Harold C. Grinnell
Director

Mathias C. Richards
Associate Director

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Report

OF THE

Director

OF THE

New Hampshire Agricultural Experiment Station

July 1, 1949 - June 30, 1951

UNIVERSITY OF NEW HAMPSHIRE
DURHAM, N. H.

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Analysis of Forage Samples

For the past three years changes in the carotene and protein content of timothy, alsike, ladino and red clovers have been followed through different methods of preservation. In 1948 and 1949 ensiling was compared with mow drying and field curing. All four species lost the least amount of carotene when preserved as silage, with mow drying in second place. Ladino lost the least amount of carotene in the silo, while red clover lost the most.

In 1950 three ensiling methods, i.e., plain, SO_2 and molasses treated, were compared with field curing using timothy, alsike, and red clover. Silage preserved with SO_2 lost the least amount of carotene.

There were no significant changes in protein during any year.

In 1951 alfalfa and brome grass were added to the list of species used in the comparison of SO_2 preserved versus untreated, both loose and packed, as well as the standard mow and field curing.

G. P. Percival
D. Josselyn

Chemical Studies Concerning The Determination of Ascorbic Acid in Foods

Two varieties of strawberries were studied this year, the Catskill, investigated previously, serving as a control, and a new variety developed at the University, the Great Bay. Changes noted during storage of frozen Catskill berries were similar to those noted in the past — very little change in composition of unsugared berries, while sugared berries again showed definite changes with regard to total acidity (increased) and "apparent increased ascorbic acid value". Interfering substances, as detected by norite and formaldehyde, were high at harvest time and dropped off somewhat during storage. The Great Bay berry had less ascorbic acid at the end of the season than at the beginning. During storage, ascorbic acid losses were noted only for the unsugared berries, increased total acid values were noted for sugared berries; ascorbic acid values for these latter were not lowered by storage.

Helen P. Shimer
S. R. Shimer

How Good are New Hampshire Canned Vegetables?

A study of the nutritive value of New Hampshire canned vegetables (tomatoes, corn, carrots and beans) has been completed at the University of New Hampshire laboratories.

Data from 405 samples collected at random from Coos, Merrimack, and Cheshire counties show that the over-all picture compares favorably with commercially canned products. As would be expected, some of the samples of any one product were low in certain nutrients; for example, four samples of beans contained no vitamin C.

A detailed report of the composite data will appear in another publication, but the following generalizations can be made at this time:

Previous statements (see 1949 report) have shown that New Hampshire grown and canned beans and tomatoes compare well with commercial packs as regards their vitamin C (ascorbic acid) content. The same is true for the vitamin A content of corn and for approximately half the carrots.

All the tomatoes and corn samples equalled, or bettered, the protein

values listed for similar commercial products, while carrots and beans averaged slightly lower.

When considering the energy values (caloric content) of these vegetables, two-thirds of all the green beans and tomatoes and half of the corn bettered the commercial values, three-fourths of all yellow beans and carrots were lower.

The mineral content (ash values) of all the carrots, especially all the beans, and 70 to 80 per cent of the corn and tomatoes, equalled or bettered published figures for similar packs. Further analyses of the ash content showed that while almost all samples contained more phosphorus than published figures, the calcium values were lower in practically all instances. No adequate explanation can be offered for these facts although it is known that the soils of the state are very low in available calcium.

The solids of corn showed the greatest variation of all total solids studied, although 80 per cent of the samples equalled the commercial figures. This same ratio held true for beans and tomatoes, while only 25 per cent of the carrots fell within the commercial range.

The cellulose content of green beans and corn, remaining after blending and straining, varied considerably. In some cases this indigestible material (crude fiber, strings, pods, hulls) from a pint of the canned vegetable practically filled the jar. This was due in all probability to the maturity of the product when preserved.

To date the data have not been statistically treated to determine factors influencing the variations in the different nutrients as reported above. When this is done the causes for some of the variations may become apparent. Such treatment may also show differences between counties as the nutritive values of samples collected from Coos county tend to be slightly lower than values from the other two counties. The only exception to this trend was noted in the mineral content of beans, corn, and carrots.

S. R. Shimer

Starch Hydrolysis in Winter Squash

Blue Hubbard squash were used in testing the apparent activity of some of the carbohydrate enzymes during the growth and storage season of 1950-51.

Amylase and invertase activities were low throughout the season with minor variations. Phosphorylase activity was low in both flesh and fiber in the early stage of growth. It increased somewhat in the flesh and greatly in the fiber at the time when starch was being formed rapidly. During storage the phosphorylase activity of the flesh decreased gradually, but that of the fiber remained at a high level.

T. G. Phillips

Study of Assay Methods For Some Water-Soluble Vitamins

A study was made of the possibilities of applying the cyanogen bromide reaction to the quantitative determination of pyridoxine. When it was ascertained that a colorimetric procedure was not practical, due to the weakness of the color reaction, the possibilities of a fluorimetric assay procedure were considered. It was found that reaction between pyridoxine and cyanogen bromide produces a highly fluorescent substance, in amount proportional to the pyridoxine present. Hence, it appears that a practical assay procedure, based upon this reaction, can be developed.

A. E. Teeri

The Effect of Soil Type, Species and Fertility on the Minor Elements in New Hampshire Forage

The timothy plots on the Paxton soil in Strafford were sampled for yield and chemical analysis in June, 1951. These plots were topdressed in 1947 with two levels of cobalt, nitrogen, lime and potassium as variables. These samples will be analyzed to determine the lasting effects of the different variables on the cobalt, manganese and phosphorus content of the timothy.

Similar plots in a Gloucester soil in East Candia were sampled in June, 1950. The results showed that potassium decreased the yield of timothy on the low nitrogen plots but increased it on the high nitrogen plots; potassium increased the yield of red clover at both levels of nitrogen. Nitrogen increased the yield of timothy and decreased the yield of red clover. Potassium significantly increased the manganese content of timothy, but significantly decreased it in the red clover. High nitrogen decreased the manganese content of timothy at both levels of potassium. but added potassium prevented a similar decrease in the manganese content of the red clover.

Both nitrogen and lime significantly decreased the cobalt content of timothy and red clover, and, when they were applied together, the effect was additive.

None of the treatments had any significant effect on phosphorus content of either timothy or red clover.

The plots laid out on the Paxton soil in Northwood, completely confounding the four-factor interaction of specie x lime x fertility x micro-elements were sampled for yield, specie content, and chemical analysis. These samples will be analyzed for micro-elements. The chemical work in the 1950 samples has not been completed.

Greenhouse work on soil from this field was continued. Barley was grown in the soil on which the previous yield of oats was significantly decreased by applications of lime at three different levels of fertility. The results showed that the two-ton application significantly increased the yield of barley at the 1 per cent level, the four-ton application at the 5 per cent level, and the six-ton application significantly decreased the yield at the 5 per cent level. Another series of pots was set up to try to overcome the depressing effect of lime on the yield of oats. Applications of manganese, boron, manganese and boron, copper, zinc, magnesium, potassium, magnesium and potassium, and iron failed to correct this trouble.

G. P. Percival
D. Josselyn

Agricultural Economics

Cost Reduction Possibilities On Dairy Farms

The over-all appraisal of cost reduction opportunities shows that dairy farmers could add significantly to their net earnings by fuller resource use through more complete adoption of current technological information. Much new technology does not materially reduce unit costs; it does, however, allow increases in volume of business with no increase in labor force, which increases both gross and net earnings. Comparison of ideally organized one-, two-, and three-man farms shows that size of operation offers little opportunity to reduce unit production costs on dairy

farms, especially when units are two-man or larger in size. However, net income does show improvement on the larger units.

A detailed analysis was made of the more profitable combinations of owned and hired machinery and equipment for representative dairy farms, with special attention to the extent to which hiring of custom services would influence the farm organization and reduce costs of dairy farm operation. This work indicates that dairy farms should be equipped with certain foundational machinery and equipment such as a tractor, manure spreader, mowing machine, rake and wagon. These items of equipment are used in repetitive jobs and do not lend to custom hiring. For the small farm with a herd of 18 cows or under, many of the other cropping operations could be profitably hired at present custom work prices. Under certain conditions the operators of the small units could buy pieces of equipment that are normally uneconomical and do custom work for other farmers. As farms increase in size the opportunities for economically using custom hired equipment become fewer.

This project has been carried on in cooperation with the Bureau of Agricultural Economics, U. S. Department of Agriculture and the University of Connecticut.

W. K. Burkett

Efficient Chore Practices In Dairy Barns

Large dairy farmers, confronted with high labor costs, have made progress in labor saving practices. A number of operators have given special attention to the storage and handling of sawdust for bedding. They are using more sawdust than before as the old method of making many trips from storage to stable, carrying sawdust in small baskets, required too much travel and time.

A few dairymen have constructed sawdust bins in the hay mow above the cows. They can draw the bedding from bins into special carts by gravity. The bins are usually filled by means of a blower.

One dairyman, in remodeling his stable, left considerable space back of the cows, and stores about 300 bu. of sawdust along the barn wall.

This operator is experimenting with a special bin and may construct this along both sides of the barn, increasing his storage capacity to 1600 bu. Sawdust will be available at all points back of the cows and can be spread quickly and easily. Once around the barn with a scoop shovel completes the task of bedding.

During the year estimates were made on seven large dairy farms as to the man hours spent on occasional chores. These estimates adjusted to a 40 cow herd basis adding up to nearly 700 man hours a year or about 17.5 man hours per cow.

H. C. Woodworth

Harvesting and Marketing New Hampshire Cucumbers under Contract

This project was undertaken to study the economic possibilities of this crop in raising the income of New Hampshire rural families, especially families with available labor, living on small part-time farms. Due to the severe drought, yields were generally low and financial results were not encouraging.

An experiment was carried out on one farm to measure the results from different frequencies of picking. The value of pickles per hour of picking was $.98 on the basis of harvesting six times a week and $2.02 on the basis of harvesting two times a week.

H. C. Woodworth

Strawberry Marketing

Studies were made with thirteen strawberry varieties which show that some keep much better than others

at room temperature or under refrigeration. Howard 17 proved to be a poor keeper while Robinson, although rated as a soft berry, kept very well.

The Great Bay variety peak yield averaged seven days later than Howard 17 for three years. In 1951 a Colebrook grower marketed one-third acre of Great Bay berries from July 7 to August 2 at a price of 47 cents per quart. In spite of a poor stand the gross return per acre exceeded $2100.

The price offered for commerical processing of strawberries is not high enough in New Hampshire to warrant sale for this purpose.

Several growers who have permitted the buyers to pick the berries have found that they can offer up to a fifty per cent discount over the retail price and still net about as much as they could by jobbing to stores in nearby towns.

L. A. Dougherty

Agricultural Engineering

Convenient Transportation Means Longer Harrow Life

Wise farmers do not haul disk harrows over gravel, rock, or hard surfaced roads, but load them on some type of transport. Many different types are employed depending on the frequency of moving from field to field and the farm management practices employed by the particular farmer. The effectiveness for preserving the cutting qualities of such a harrow is directly dependent on the ease with which loading and transporting can be done, particularly on farms where such work is not done by the owner.

The accompanying picture shows a harrow carrier of the overhead suspension type built by University of New Hampshire Agricultural Engineers early in 1951. We believe this

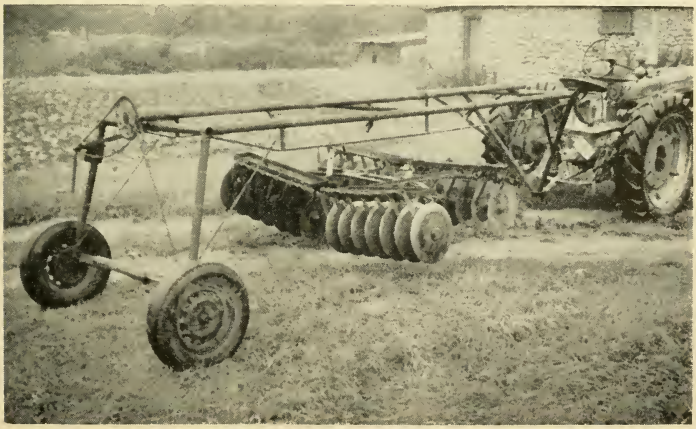

Figure 1. The overhead suspension type harrow carrier which was built by agricultural engineers at the University.

unit, through its ease of operation, offers the greatest incentive to the operator to load his harrow for even the shortest hauls. A few similar units are already in use on New England farms. We have been able to study the process of construction and its use under operating farm conditions. When these studies are concluded. plans and construction information will be made available to farmers. Farmers with a different type of harrow carrier may prefer their designs, but the important thing is to save harrow maintenance costs by using some type of carrier.

Bernard P. Rines
Arthur D. Leach, Jr.

Front Opening Type Milk Cooler Shows Promise

A comparison of the front opening type of milk cooler with the common immersion type shows several advantages for this newer machine. The front opening cooler, sometimes called the side opening cooler, reduces the temperature of the milk to less than 50°F in one hour, which is only three to eleven degrees higher than that cooled by the immersion type in the same length of time.

Performance of the front opening cooler is equal to the immersion cooler except where it is desirable to cool the milk to temperatures below 50°F in cases of high initial bacterial count or where the milk is to be held longer than 24 hours.

Convenience seems to be the major attraction for the front opening cooler. Only a four to six-inch lift is necessary in handling the cans. These coolers are narrower and are adapted to narrow doors. There is no manipulation necessary to maintain the proper water level. Pits are discouraged by boards of health and are being eliminated.

Operating costs are about equal for the two types. Power consumption varies more among makes of coolers than it does between the two types studied.

Arthur G. Fox

Home Made Conveyors Save Time and Labor in Removing Baled Hay from the Mow

Two types of conveyors which can be easily constructed in the farm shop have been developed at the University to reduce the labor requirements for moving baled hay out of the mow. One of these conveyors uses gravity, and the other is powered by a fractional horsepower electric motor.

These conveyors may be used separately or in combination with each other. By using one of these conveyors, ten or twelve feet long, to move baled hay from the pile in the mow to the hay hole or feeding floor a man can save 20-25 feet of travel per bale. In some cases conditions may be such that the conveyor can be preloaded for the next feeding and eliminate one or more trips to the mow each day by having a switch or release on the feeding floor. Some farmers who use one of the many types of bale elevators now marketed to put their hay into the barn could use the home made conveyors to carry the hay farther back in the mow at haying time.

The gravity feed conveyor is made up of rollers about two feet long, spaced between six and ten inches apart (depending upon the diameter of the rolls), and supported by a 2″ x 4″ on each end. The rolls can be made from either 4″ x 6″ aluminum irrigation pipe or 4″ bituminized-fibre drain pipe. The cost of materials for one of these conveyors 10 feet long varies between $15 and $35 depending on the size, type, and spacing of rolls. These can be made in sections 10 to 12 feet long and joined together to form a continuous conveyor.

If the bales are too loosely tied and flexible they will not roll satisfactorily on the gravity conveyor without help.

The electrically powered conveyor is about twelve feet long and two feet wide. It has a capacity of six bales when they are piled two deep. This conveyor will handle all types of bales whether they are loosely tied or not, and it can be more easily adapted to preloading than the gravity type conveyor because it can be more easily controlled from the feeding floor. The materials for this conveyor cost about $100 to $125.

This is considerably more than the gravity conveyor but the difference is partly offset by a more positive operation and its wider range of adaptability.

B. P. Batchelder, Jr.

Wagon Unloaders May Aid in The Removal of Chopped Hay To the Feed Floor

Farmers who have a canvas type wagon unloader can make greater use of their present equipment and save time and labor in removing chopped hay from the mow.

An inexpensive device for removing chopped hay from the mow is being tried at the University. This conveyor was made of a wooden roll, a length of canvas, a fractional horsepower electric motor, and a reduction unit — which is usually a part of a wagon unloader. The conveyor is easily assembled by attaching the canvas to the roll and powering the roll by the motor through the speed reduction unit.

Some means of declutching the roll from the drive mechanism to enable the canvas to be pulled out for loading is desirable, but not necessary if time is not of greatest importance.

After the canvas is loaded this unit can be controlled from the feed floor. As much or as little chopped hay as desired can be brought through the hay hole into the feed cart or to any other feeding device. In many barns this device would necessitate a man going to the mow only once a day or less.

The cost of materials of a farm-made unit without the motor and reduction unit is approximately $30. The cost of reduction unit and electric motor range from $100 to $220. The reduction unit has many other uses.

A. G. Fox
B. P. Batchelder, Jr.

Low Cost Insurance Against Electric Power Loss

Electricity is preferred by many farmers as the source of energy. Its dependability, however, varies depending on the weather and the location of the farm. Many large poultrymen have long considered automatic stand-by generating plants an economic necessity to prevent losses during power loss, but the cost of such automatic generating plants could not be met by small farmers.

Recently, non-automatic belt driven generators have been placed on the market at a price which places stand-by electricity within reach of many more farmers. These generators are operated by the farm tractor, and were designed to be bolted down to a fixed mounting block in the tractor shelter, or at some other location near the electric load center of the farm.

The possibility of mounting a belt driven generator on the tractor has been studied. Such an arrangement would make the generator useful in combating power loss at more than one location. Even more important are the possibilities of operating electric equipment away from the farm buildings. Grinders, drills, and other shop tools could be taken to machines in the field. Hay, sawdust, and litter conveyors which were built for electric operation near

the buildings could be used occasionally at remote places without changing power units or wiring. The ingenious farmer will find many more jobs to increase the earning power of such a stand-by generator.

The practicality of mounting these units on the tractor has been demonstrated, but the time required for installing present mountings is considered excessive. The studies will continue until a design is found which one man can install alone in five minutes with a minimum of tools.

B. P. Rines

Infrared Brooding of Chickens and Poults

As a result of many inquiries about infrared brooding, tests were conducted during the winter and spring brooding season to determine its application to New Hampshire's climate.

The work began on January 25 on 500 chicks under a rectangular unit of eight 250-watt lamps and four thermostats as was being recommended by various poultry magazines at that time. During the first extreme cold period experienced, it was found that five 375-watt lamps arranged in a circle made the chicks more comfortable even though the total wattage was less.

Observations made during the first trials indicated no advantage in changing height of lamps above litter after the initial setting (18 inches for 250-watt; 24 inches for 375-watt), and this was confirmed on poults during the spring where height remained constant.

Crooked toes were prevalent among the chicks brooded in the winter months, and as a safeguard against this, floors were kept warm or well covered with litter.

The use of thermostats to control one or more lamps in a unit increases first cost but reduces operating costs. The period of use and the management practices of the operator (as they affect cost of manual control) determine the number of thermostats which can pay for themselves. It is hoped that future investigation will provide a means of control superior to the individual thermostat for the small poultryman. Thermostats and thermometers cannot measure infrared radiation directly, but only its effect on the surrounding atmosphere.

Since one of the effects of these lamps is to warm the air directly beneath them, strong convection air currents are set up in the house with the rise of air occurring at the lamp support. In the work on poults, two units with baffles (or semi-hovers) were used with success in slowing down these convection currents. As a result, the comfort of the birds was noticeably increased, and energy consumption lowered. These baffles were so designed that the advantage of seeing all chicks at a glance was retained.

Mounting the lamps in swivel sockets proved a most satisfactory way of changing the radiation pattern as the birds grew.

Other points to keep in mind using infrared lamps for brooding are (1) some means of heat retention, or a stand-by generator, is necessary insurance against power loss and (2) for economy the house should be well insulated.

B. P. Batchelder, Jr.
W. C. Skoglund
B. P. Rines

Bacteriology

Diagnosis and Treatment of Mastitis

Staphylococci are an important cause of acute or chronic mastitis in many dairy herds. Methods have been developed which make it possible to detect these pathogenic bacteria in milk samples. The manner in which these organisms are spread from cow to cow is being studied.

Aureomycin has continued to give highly satisfactory results for the treatment of chronic and acute mastitis when administered via the teat canal in an ointment base. Particularly significant is the fact that, with this drug, it was possible to cure a number of cases of the long-standing, chronic type of streptococcic mastitis. Many of these cases had histories of producing discolored or stringy milk and the majority of these quarters had not been cured with penicillin, even when large and repeated doses were administered. While staphylococcic mastitis is more difficult to treat than streptococcic mastitis, encouraging results have been obtained with the aureomycin and further studies are being made to determine the most effective method of administration. Other antibodies such as Terramycin and Pendistrin (Penicillin and Streptomycin) are also being tested. It should be noted that cows with highly inflamed, swollen udders cannot be treated satisfactorily via the teat canal.

A severe outbreak of *Pseudomonas aeruginosa* mastitis in a dairy herd has also been studied. To date, it has not been possible to cure the infected quarters by treatment with aureomycin, terramycin, or streptomycin.

L. W. Slanetz
F. E. Allen
L. E. Scarce

Treatment of Brucellosis (Bang's Disease) With Aureomycin

Sixteen cows in a Brucella infected herd were used for this study. Extensive tests were first made to determine the agglutinin titre of each cow and to determine whether the cows were shedding *Brucella abortus* organisms in the milk. Twelve of the cows were then given intravenous injections of aureomycin. Some of the cows also received udder infusions of aureomycin and sulfamethazine orally. Four cows were used as controls and received no treatment. The results to date indicate that the Brucella infected cows have not been cured by the treatments administered.

L. W. Slanetz
F. E. Allen
C. L. Rollins

Crops and Pastures

Birdsfoot Trefoil Work Under Way

The first successful seeding was made on the Foss farm, where the crop has been pastured for three successive seasons. It appears to be thicker this year in places than it was during the three previous years. These areas on the Foss Farm were seeded for observation purposes. The soil is a very heavy one on which birdsfoot seems to be well adapted.

Birdsfoot trefoil has been used also on 15 acres of low land recently improved in a drainage project. These areas are also for observation.

Nine strains of trefoil were seeded in August, 1949, on the Bunker field as a variety test. These strains are

principally those which were secured from the Cornell Experiment Station, and include the Empire, Viking, and certain other selections. For further information, a strain obtained from Northern Italy was included.

Because of the drought only one harvest was made from this test in 1950. There was much difference in the rate of recovery after the first harvest, some of the Empire crosses making much better growth than Empire itself and the Italian strain. Since ladino recovers more quickly than trefoil, it isn't likely that trefoil will replace ladino on lands where the latter is adapted. It seems probable, however, that trefoil may be used in situations where ladino will not survive, since trefoil appears to be better adapted to wet soils than ladino.

F. S. Prince

New Alfalfa Varieties Being Tested

Some of the newer alfalfa varieties that have been developed by plant breeders in the United States appear to show considerable promise for New England. Among these are Ranger, a wilt-resistant variety; others include the Atlantic, a variety developed at the New Jersey Station which appears to contain some disease-resistant qualities and the Narragansett which originated at the Rhode Island Station.

These three new and promising varieties are being grown in Greenland, N. H., in a variety test which includes also the Grimm, Ontario Variegated, and Buffalo varieties. Buffalo is also a wilt-resistant strain, developed from Kansas Common. It is believed that it will not be so well adapted to New Hampshire conditions as the Ranger which was developed from hardier strains.

At the first harvest in 1951, the Narragansett variety was outstanding. This has been the case with Narragansett in other tests in the Northeast, in that for the first two or three years, at least, Narragansett outyields all the other available varieties. Whether it will show the same high yielding ability more than three years is questionable, since it has not been bred especially for resistance to disease. It is outstanding enough now in yield to be recommended for seedings which are designed to last not more than three or perhaps four years. Additional information may prove it to be good for plantings of longer duration.

F. S. Prince

Progress with New Hampshire Perennial Red Clover

Normally, red clover is considered to be biennial, but some plants tend to persist longer than the usual two years. Over fifteen years ago, members of the Agronomy Department gathered seed from isolated plants throughout the State. It was noted that some plants grown from these seeds lived longer than the usual two years. In fact, seed was produced from these plants at the end of the third and fourth years and, to a limited extent, after the fifth year.

By hand pollination in the greenhouse among the twelve original families that showed the perennial characteristics, succeeding generations have been obtained and selections have been on the basis of freedom from disease and vigor. Some seed has been multiplied and trial samples have been sent to the United States Department of Agriculture for trials in other states, and to the various county agents within New Hampshire. In the early trials, New Hampshire Perennial Red Clover has yielded better and has lived longer than the usual commercial red clover and some of the named varieties.

During the last year or two, by intense careful selection, a new lot of breeders' seed has been obtained.

Part of this has already been planted. Its performance will be an indication of the progress made to date.

L. J. Higgins

Smooth Brome Grass Strains Under Test

Smooth brome grass is increasing in importance as a forage crop in New Hampshire. It is taking the place of timothy in many seedings and promises to assume a great deal of acreage on dairy farms, particularly when seeded with ladino clover or alfalfa.

New strains of smooth brome that have been produced in plant breeding programs in the northeast region are being tested in New Hampshire. During the summer of 1950, six synthetic strains and 25 lots of seed produced from promising smooth brome families were seeded in small plots on the Whenal farm in Greenland, N. H. Each strain was replicated four times in properly randomized plots and all are being compared with Lincoln, the most popular southern brome variety, and a Canadian or northern brome strain. Two strains produced by the New Hampshire Station are included also in this series of plots.

The synthetics are seeded alone, and also with alfalfa in this test. While no yield data are as yet available, by such testing it is hoped to determine whether any of the new lines are superior to those now being used. If any are found that are superior yielding or are better for some other factor, such as disease resistance, steps will be taken to multiply the seed for commercial use.

F. S. Prince

Kennebec Most Promising New Potato Variety

Each year, twenty or more potato varieties are grown in Durham, to rate them for yielding ability. The more promising ones each year are produced in a tuber unit seed block at Colebrook. The Kennebec, a new variety originating in Maine, was the highest yielding potato in the variety testing program in 1950. It makes excellent potato chips, but is not so mealy as the Green Mountain.

Many new varieties of potatoes are being released through the National Potato Breeding Program. As fast as these are released in this area, either as numbered or named varieties, they are subjected to testing in our research program. Here they are compared with Green Mountain and other standard varieties.

P. T. Blood

Potato Varieties for Chipping

Twenty-two varieties were tested for their suitability for chips during the winter. These had all been produced in our variety testing program at Durham.

Some varieties such as Kennebec, Mohawk and Russett consistently make good marketing chips, while others such as Essex and Cortland just as consistently make poor chips. A good chipping variety must not contain an undue amount of reducing sugars. Since these varieties behave as they do, the amount of reducing sugar in any variety must be considered to be a genetic factor.

P. T. Blood

Disease-Resistant Oats for New Hampshire

Until the early 1940's, oats were not a "sure crop" for grain. Some years, farmers harvested a 75-bushel crop, and other years the same variety produced only 25 bushels. The difference was generally due to disease; some years stem rust, crown rust and smut were more prevalent than in other years.

In 1943, the Agronomy Department, in cooperation with the U. S.

D. A., established uniform oat nursery trials on the University farm. As each new disease resistant variety became available, it was tried out in the plots. Several new varieties have shown high yielding capacities, but have had to be abandoned for various reasons. The outstanding example was Vicland, which was a victim of Victoria blight.

Such varieties as Clinton, Ajax, and Mohawk have proved to be satisfactory and the New Hampshire farmers are using them. These disease resistant varieties not only insure good grain yields each year, but are also superior for annual hay, nurse crops and grazing.

Trials replicated at least three times at Claremont, Durham, and Lancaster since 1948 show a difference in response for each variety in the different localities. Generally, oats yield better in the Lancaster area than in southern New Hampshire. Yields have averaged better than 5 tons of forage per acre and, in some cases, grain yields have approached 100 bushels to the acre.

The last two years have brought to light some new varieties that yield higher than the disease-resistant varieties now used, but seed has not been multiplied fast enough as yet to make them available in sufficient quantity for planting. Indications are that oat variety changes will be frequent in the near future.

Following is a summary of the oat variety trials:

Variety Resistance	*Forage Yield per Acre*	*Grain Yield per Acre*
No disease resistance	2-3 tons	20-35 bu.
Resistant to smut only	2-3 tons	25-40 bu.
Resistant to stem rust	3-4 tons	55-65 bu.
Resistant to crown and stem rusts and smut	3-5 tons	60-70 bu.
"Top" resistant varieties	5-6 tons	80-90 bu.

L. J. Higgins

Hybrid Corn Yield Tests

New Hampshire farmers continue to change from the old open-pollinated varieties of grain and silage corn to the hybrid varieties recommended by the Experiment Station. In the early 1930's, less than 1 per cent hybrid corn was grown in the state, whereas now it is estimated that 85 per cent of the corn is hybrid. A 10 per cent gain has taken place during the last two years.

Since 1936, when the Agronomy Department started the variety trials, the summary of yield average would be as follows:

Variety	*Silage Yield per Acre*	*Grain Yield per Acre*
Flints-open-pollinated	8-10 tons	30-40 bu.
Dent-flint hybrids	10-12 tons	45-50 bu.
Dents-open-pollinated	12-15 tons	55-60 bu.
Dent hybrids	15-20 tons	65-70 bu.
Dent-sweet hybrids	20 plus	Not suitable for grain

In spite of the drought experienced during the 1949 and 1950 growing seasons, hybrid corn varieties showed significant differences in yields at Durham, Claremont, and Lancaster. Furthermore, hybrids brought in from outside of the state respond differently in New Hampshire localities than they do in their original habitat. Due to seasonal variations,

each variety is grown at least 3-5 years in several replications and in more than one state area before a recommendation is given.

Cornell 29-3 continued to be the leading early silage and grain corn variety in the state. If planted late in May, it gives good tonnage for silage even at Lancaster. Massachusetts 62 and Wisconsin 335 may be substituted.

As a result of the Lancaster trials, the dent-flint hybrids, Maine B and Wisconsin 240, have matured just as early as have the local flints for grain. Also, the hybrids have given a 5-10 bushel increase in yield.

In southern New Hampshire, Cornell 29-3 matures early enough for grain, along with Massachusetts 62 and hybrids of the 300 and 400 Wisconsin series. In some southern upland areas, dent-flint hybrids or dent hybrids of the 200 Wisconsin series are recommended.

Because of differences in strain and stalk breakage, the old open pollinated West Branch Sweepstakes is losing ground as a late silage corn in central and southern New Hampshire. Ohio M-15 and to a lesser degree Ohio K-24 are now being used. Wisconsin 692 continues to give a much higher tonnage yield, but matures somewhat later.

The new dent-sweet hybrids can be used for silage, but not for grain. Under controlled field conditions, these hybrids have topped all previous silage yields, consistently exceeding 25 tons to the acre. They are unfortunately a little late in maturing.

L. J. Higgins

Irrigation to Improve Pasture

How to produce enough pasture for the dairy herd in droughty seasons is a problem that has bothered many farmers for the past several years. Serious droughts occurred during the growing seasons from 1947 to 1950. During these years, a number of irrigation systems were purchased by New Hampshire farmers.

To test the effectiveness of irrigation on pasture production, an overhead irrigation system was installed in 1949. The equipment consisted of an OCD pumper with quick connecting aluminum pipe and small sprinklers, each within an effective radius of approximately 40 feet.

Drought began in June, 1949, but irrigation was not begun until July 17. The areas to be irrigated included one four-year old piece of ladino and timothy and one two-year old field of ladino, red clover, and timothy. Irrigation water was applied four times or until the moisture content of the soil indicated that irrigation was no longer necessary. The content of soil moisture was measured as often as necessary by means of gypsum blocks, randomized over the area, amounting to 500 pounds of a 7-7-7, although the land had all been previously treated in May.

Yield records were obtained by means of four-foot square cages properly replicated over the area. Data were recorded in terms of oven dry material. In the table, the yields from both areas were combined since the response for irrigation was similar on the two sections.

Treatment	*Lbs. Oven Dry Material Per Acre*	*Per cent*	
		Grass	*Clover*
Fertilized and Irrigated	3,321	87.6	12.4
Unfertilized and Irrigated	3,237	80.6	19.4
Fertilized but not Irrigated	1,748	94.9	5.1
Unfertilized and not Irrigated	1,097	93.4	6.6

Water was applied four times during the period from July 17 to August 15, or approximately at weekly intervals. Since the sprinklers used do not distribute the water exactly evenly over the area, the cages were so set as to cover the dry as well as the wet segments of the areas to be irrigated. Approximately one inch of water was applied at each watering. There was a gain of 1,573 pounds of oven dry weight for the fertilized. irrigated areas and 2,140 pounds for the unfertilized, irrigated sections.

A response for fertilizer was obtained on the non-irrigated areas, but not on the irrigated sections. perhaps because the land had been top dressed in May before irrigation started and had, in fact, been top dressed annually.

Drought in the Durham area was slightly more severe in 1950 than in 1949. Rainfall from June 5 to August 19 totalled only 3.98 inches. The experimental area consisted of a new seeding of clovers and grass that had been made in March on land plowed directly from sod and prepared in the autumn of 1949. The first irrigation water was applied June 17 and watering continued until mid-August or until seven inches of water were applied at as many applications.

The areas under irrigation were pastured twice, but not enough of a stand developed in the non-irrigated portions of the field to provide pasture of much value.

The increase for irrigation of 2,992 pounds of oven dry forage would probably approximate 15,000 pounds green grass, a volume sufficient to furnish 100 days of pasturing for one cow at 150 pounds of green grass per acre daily. Since pasturing did not start until mid-July, this appears to be a very satisfactory yield.

More important is the fact that a very much better stand of grass and clovers was obtained on the irrigated portions of the field. Lack of irrigation might result in a complete loss of stand in extremely dry seasons.

A similarity is noted here between the increases for irrigation for the two years since in both seasons an inch of irrigation water caused an average increase of a little over 400 pounds. This would amount to approximately one ton of green grass.

F. S. Prince
P. T. Blood
L. T. Kardos

Boron is Essential For Best Yields of Ladino Clover

Greenhouse experiments with different amounts of borax and lime indicated that best yields of ladino clover were obtained when the soil was treated with one ton of lime and borax at a rate of 10 pounds per acre. When the same soil was treated with one ton of lime and borax added, the yield was about 23 per cent less. When the equivalent of 40 pounds of borax per acre was used, the yield was slightly depressed but still remained 10 per cent greater than where no boron was used. From these results, it appears that borax applications commonly recommended for alfalfa seedings would not be seriously deterimental to ladino clover which might be planted with the alfalfa.

L. T. Kardos
F. S. Prince
P. T. Blood

Continued Use of Fertilizers Containing Borax Is Detrimental to Yield of Potatoes

As a result of experiments carried out on Worthington loam soil in the Colebrook area, it has been found that when as little as five pounds of borax per acre were added with the fertilizer in the land, and when such application was made in each of five

consecutive years, a decrease in yield of potatoes of 43 bushels occurred in the fifth year.

Where 20 pounds of borax were used, the yield decreases occurred in the second year. In the fifth year the decrease in yield amounted to 93 bushels.

Where potatoes are being grown continuously on the same land, care should be exercised in using fertilizers continuously if borax has been added.

F. S. Prince
P. T. Blood
L. T. Kardos

To Avoid Scab, Use Extreme Care In Liming Potato Soils

In liming experiments with potatoes at Colebrook, a soil with an initial pH of 4.8 was used. One set of plots was treated with 500 pounds of lime per acre each year while another received no lime. Potatoes were grown each year.

None of the potatoes were scabby during the first three years while the pH was rising from 4.8 to 5.1. However, in the fourth year at a pH of 5.2, approximately 22 per cent of the potatoes on the limed plot were moderately to badly scabbed. When the soil pH reached a value of 5.3 in the fifth year, almost 66 per cent of the tubers were affected.

The unlimed plots in the fifth year had a pH of 4.7 and had no scabby potatoes. There was no significant difference in yields of potatoes on the limed and unlimed plots.

If the potato grower is following a rotation involving legumes and wishes to obtain a good stand of clover, he should check his soil pH and not use more lime than would raise the soil to a pH of 5.1. For soils with a pH of 4.8 to 5.0, not more than 500 pounds of limestone should be used in any one rotation sequence and it should be applied just prior to seeding down. For soils below pH 4.8, not more than 1000 pounds of limestone should be applied during any one rotation sequence.

F. S. Prince
P. T. Blood
L. T. Kardos

Dairying

Does Method of Preserving Roughage Affect Vitamin Synthesis in the Rumen?

Three methods of preservation and storage of forage were compared with respect to their effect upon vitamin synthesis in the digestive tract of cows. Fecal and urinary excretions of the vitamins were measured. Whether the roughage was field-cured, mow cured, or ensiled had no significant effect upon the excretion of nicotinic acid or panthothenic acid. The rumen synthesis of thiamine, however, was favorably affected by the feeding of silage.

A. E. Teeri
D. Josselyn
N. F. Colovos
H. A. Keener

Fine-Ground Grain Mixture Digested and Utilized Better By Dairy Heifers

There has been considerable speculation among dairymen and feedmen as to the relative feed value of coarse-ground grain for dairy cattle as compared to fine-ground grain. Because a coarse grain is more expensive than a fine grain, an experiment was set up to determine whether paying a higher price for the coarse feed is justified from the point of view of digestion and utilization of the protein and energy.

In eight complete energy and protein balances with four heifers the finely-ground grain mixture excelled the coarsely-ground mixture in both

digestibility and utilization of protein and energy. These results contradict any advantages claimed for the purchase of the higher priced coarse dairy feed for dairy cows.

N. F. Colovos, H. A. Keener,
A. E. Teeri and H. A. Davis

Grass Silage Produces Good Growth When Fed to Dairy Heifers

In a continuation of the work to determine the best method of preserving forage, silage was found to contain the most protein on the dry basis, mow-cured hay was second, while field-cured hay was lowest. The forage used was a grass-legume mixture containing a high percentage of red clover and it was harvested so that the material stored by all three methods would have had the same original composition. When these forages were fed to 12-18 months old dairy heifers as the sole ration, silage produced by far the best gains; field-cured hay was intermediate, while the mow-cured hay produced the smallest gains. This was in spite of the fact, as reported elsewhere, that the silage was much inferior to both hays with respect to the digestibility of both protein and energy.

In other experiments with heifers of a similar age, oat silage preserved with sulphur dioxide produced gains in body weight which were just as high as those produced by a similar silage preserved with molasses. The sulphur dioxide preserved silage was also higher in carotene and had much better keeping qualities during warm weather than the molasses treated silage. Better than normal gains in body weight resulted from feeding a ladino-brome silage as the sole ration. When timothy silage was fed as the sole ration, the growth rate was very poor, but it was improved to some extent by feeding corn silage along with the timothy silage. Corn silage also increased the growth rate when it was fed along with hay.

It is concluded that normal body weight gains can be made by dairy heifers after one year of age when they are fed only high quality grass-legume silage alone or in combination with corn silage. Good grass silage appears to contain some sort of growth-promoting factor (or factors) in much greater quantities than is found in hay. The ensiling of a poor quality forage will not make a high quality feed out of it. Sulphur dioxide appears to have considerable possibilities as a silage preservative.

H. A. Keener
N. F. Colovos
H. A. Davis

Limestone Lowers Digestibility Of Silage

Because of the lower digestibility of silage compared to mow-cured and field-cured hay as determined in experiments elsewhere reported, it was deemed desirable to determine the causes of these differences. It was thought that pulverized limestone, a common mixed concentrate ingredient, might be used to neutralize the acidity of the silage and perhaps improve its digestibility. Contrary to this idea, however, the reverse was found to be true. The feeding of ground limestone at a rate of 100 g. per day caused a drop of 6 to 8 per cent in the digestibility of the protein in the silage.

The results of this investigation pose the very important question as to what harm, if any, inclusion of minerals in the ration in improper proportions may cause in the digestion and utilization of its nutrient constituents.

N. F. Colovos, H. A. Keener,
A. E. Teeri and H. A. Davis

Minor Element Content of Forage Can be Reduced by Heavy Use Of Fertilizer and Lime

The trend among progressive dairymen in this area is to apply commercial fertilizer and lime more heavily to the soils on which forage crops are grown in order to obtain greater yields per acre. The high quality forage thus produced is pastured or harvested and stored so that its feeding value will be as high as possible. With this type of program much less feed, particularly concentrates, is purchased from other farms or from other areas of the country. Other research has suggested that such a situation may lower the minor element content of the ration. In order to determine what effect such a program may have on the chemical composition of the forage and on the growth, reproduction and production of cattle, a long time experiment is being conducted. The forage is being grown at Northwood while the cattle are being maintained under controlled conditions at the Dairy Husbandry Nutrition Research Barn at Durham.

During the first year of the experiment timothy produced under intensive fertilization was low in cobalt, iron, and copper. The same was true for brome grass. The ladino clover with which the brome grass was grown was lower than normal in cobalt and iron, but it was not as low in these elements as were the grasses. Calves fed the timothy hay developed marked cobalt deficiency symptoms, while calves fed the ladino-brome hay developed moderately severe cobalt deficiency. This is contrary to the general opinion that cattle which are fed a forage containing a considerable percentage of legumes receive adequate cobalt. At the present time cobalt deficiency is the only deficiency which has been found to affect the cattle on this experiment in any way. Conclusions in regard to other elements will have to await future developments.

H. A. Keener
G. P. Percival
K. S. Morrow

Radioactive Cobalt Used In Mineral Studies

Studies on cobalt deficiency at this Station and elsewhere have shown that when cobalt is fed to deficient animals, recovery takes place very rapidly. When cobalt is injected into the jugular vein, however, larger amounts of cobalt have to be given and recovery takes place more slowly. If cobalt functions in the rumen as has been believed generally, an explanation was needed as to why injected cobalt brought about any response at all.

In order to see if cobalt could make its way into the rumen contents from the blood stream, an experiment was carried out in which radioactive cobalt was injected into cobalt deficient sheep. A very small amount of the injected cobalt was found in the rumen contents and it appeared to be enough to explain the slow response from cobalt injections. Using the radioactive isotope, it also was found that cobalt carbonate, which is relatively insoluble in water, can be absorbed into the bloodstream in appreciable quantities. It is known that cobalt carbonate will relieve cobalt deficiency. This work, however, does not indicate just where cobalt carbonate goes into solution.

H. A. Keener
G. P. Percival

The Effect of Sulfathalidine on the Excretion of Water-Soluble Vitamins By Ruminants and on Their Utilization and Digestion of the Protein and Energy in the Feed

Oral administration of sulfathalidine to heifers resulted in a signifi-

cantly decreased fecal excretion of thiamine. The urinary excretion of thiamine and the fecal urinary excretions of nicotinic acid, pantothenic acid, and riboflavin were not significantly affected. Total excretion of thiamine and of panthothenic acid were considerably greater than dietary intakes, indicating rumen or intestinal synthesis of these vitamins.

The utilization and digestibility of the protein and energy in the ration were lowered quite markedly in those animals receiving the drug.

A. E. Teeri, M. Leavitt, D. Josselyn, N. F. Colovos, and H. A. Keener

Trench Silo Proves Successful

Although the trench silo is not a new development, it is relatively new to New Hampshire dairymen. Because of the rapidly increasing popularity of grass silage in this area, dairymen have been interested in this type of silo as the answer to the high initial cost of conventional silos. In order to have first-hand information on the construction and use of the trench silo, one was constructed at the University Dairy Nutrition Research Barn in 1950.

Part of the trench was filled with field-chopped forage, the remainder was filled with similar material in the unchopped state. Molasses was added to both at the rate of 80 lbs. per ton of forage. After packing by driving a tractor back and forth over it, the forage was covered with tarpaper and 8 to 10 inches of green sawdust.

The amount of spoilage was relatively small. Both types of silage were of excellent quality. It was considerably easier to remove the chopped silage from the trench than the unchopped, but it was not too difficult to remove the unchopped material when it was forked from a reasonably sized area in much the same manner that long hay is removed from the mow.

Although a trench silo has some disadvantages, it may be used to advantage on many dairy farms. This is particularly true where financial resources are limited or where silage storage is needed quickly or for only a season or two.

H. A. Keener
N. F. Colovos

Utilization of Protein in Grass Silage Far Superior to Hays

In the continued efforts at this Station to find the best possible method of harvesting and storing home-grown roughages for winter feeding, the relative utilization and digestibility of the protein and energy of various roughages were studied. The forages, obtained from comparable stands, were ensiled, mow-cured, and field-cured. In 24 complete energy and protein balance experiments using four dairy heifers, it was found that the silage far excelled the mow-cured hay and field-cured hay in protein utilization when compared on the dry matter or digestible protein basis. This was in spite of the fact that the digestibility of the protein was higher in both the mow-cured and field-cured hay. This may explain the reason why greater gains in body weight as reported elsewhere resulted when silage was fed than when either mow-cured or field-cured hay made up the ration.

N. F. Colovos, H. A. Keener, A. E. Teeri and H. A. Davis

Vitamin D Helps Calves Make Better Use of Their Feed

Many dairymen have the rather common fault of being careless when feeding their non-producers and especially their calves. Oftentimes unpalatable stemmy leftover hay from the milking animals, instead of being discarded or used as bedding,

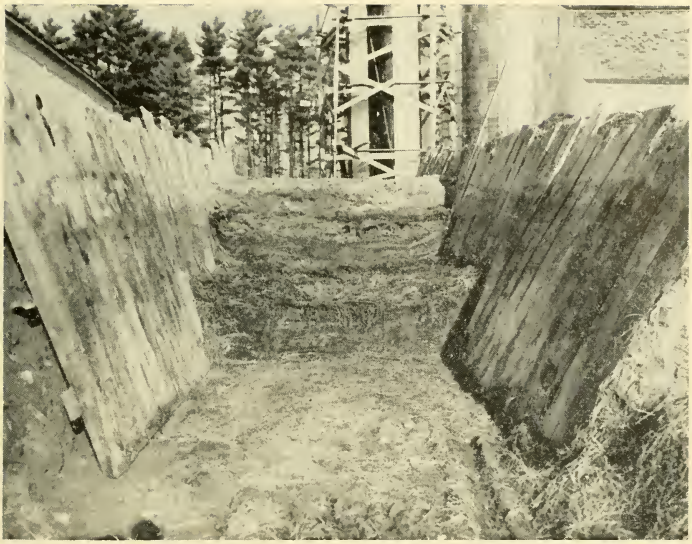

Figure 2. A trench silo constructed for research work at the University.

is fed to the calves. On other farms little hay is fed until the calf is several months old. In both cases a vitamin D deficiency is likely to result if supplemental vitamin D is not fed.

An attempt was made to study the effects of vitamin D deficiency in an experiment with calves fed a vitamin D ration and maintained in the absence of sunlight. It was found that the basal metabolism was increased quite markedly in the deficient calves long before any visible rachitic symtoms were observed. The protein in the ration was utilized to a greater extent by the calves when they were given a small supplement of irradiated yeast. The vitamin D supplement also prevented rickets. From the results of the experiment, a moderate supplement of vitamin D is recommended in the ration of the calf not only to prevent rickets but to enable it to make better use of its feed.

N. F. Colovos, H. A. Keener, A. E. Teeri and H. A. Davis

Improving the Processing, Packaging And Shipping of Bull Semen Used for Artificial Insemination

A container has been developed for carrying bull semen by the technician while in the field. The container consists of a copper can 5¾ x 4½ x 3¼ inches, with twelve ½ inch copper tubes evenly spaced in the can for holding the semen vials. The vials are 12 x 75 mm. and hold about 5 ml. of semen.

In use, the container is nearly filled with water and placed in the freezing compartment of a refrigerator and left there until frozen solid. The technician's kit has an insulated

box placed in one end that is just large enough on the inside to hold the container, with the lid being on the top of the box. When the container is removed from the freezing compartment, the copper tubes are filled with cold water for about 30 seconds to start the ice melting. The vials holding the semen are placed in the tubes and the container placed in the insulated box. Since the vials are in the copper tubes that are surrounded by ice-water, the semen is held at approxmiately the temperature of an ice-water mixture as long as there is any ice left in the can.

Fourteen of the twenty-five circuits of the New Hampshire Breeding Association are using the container. The 60 to 90 day non-returns for the three circuits that used the container for ten months this year are a slightly better percentage than that of the non-returns for the whole whole Association for the same period. The farmers are getting more selection of bulls because with ther-

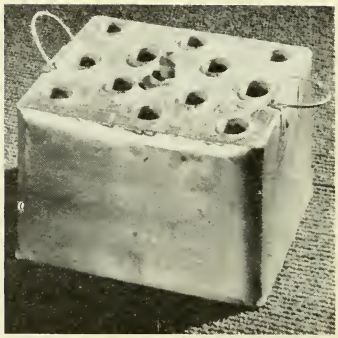

Figure 3. A container developed for carrying bull semen by the technician while in the field.

mos many technicians were carrying only one bull of each breed, while with the container, they can carry semen from two or three bulls of each breed with no particular inconvenience.

H. C. Moore

Entomology

European Corn Borer Control

Experiments conducted at Pittsfield, N. H., in the summer of 1949 indicate that parathion may be used to replace DDT in late applications for corn borer control on canning corn, thus reducing the residue problem for growers who plan to feed the crop remnants to dairy cattle.

When a 1 per cent parathion dust was substituted for the usual 3 per cent DDT dust in the third and fourth applications, harvested ears were 94 per cent borer free. Moreover, this schedule allowed a lapse of six weeks from the date of last DDT applications to the date of harvesting of canning corn.

The use of commercial DDT emulsion (Pestroy) in four applications at the rate of 1 lb. actual DDT per acre per application, resulted in satisfactory borer control, but the spray material caused some chlorisis of the plants.

In tests on market sweet corn during the summer of 1950 a 3 per cent DDT dust gave better control of the European corn borer than did a 5 per cent dust of organic phosphate.

J. G. Conklin
R. L. Blickle

Control of the Plum Curculio on Apple

In the spring of 1949 Rothane and Compound No. 1189 were compared in tests conducted for plum curculio control. Best results were obtained with Compound No. 1189 (25 per cent wettable powder) at 4 lbs. per

100 gallons. The same material at a 2 lb. dosage was as effective as parathion (15 per cent wettable powder) at 1½ lbs. The results indicated that Rothane shows little promise of being effective against the plum curculio. In 1950 a combination of methoxychlor-lead arsenate, and methoxychlor alone gave a better control of the plum curculio than did the standard lead arsenate-DDT combination. Parathion plus carbon safener was slightly superior to parathion alone.

Control of Cucumber Beetles On Pickling Cucumbers and Winter Squash

A dust comprising 6 per cent Marlate and 10 per cent Zerlate was slightly inferior to the standards C-O-C-S cucurbit dust in controlling cucumber beetles on pickling cucumbers, but gave superior results when used on turban squash. Yield in this case was increased by approximately one-half ton per acre.

J. G. Conklin
R. L. Blickle

Synergists for Insecticides

During the years 1949 and 1950 various chemical compounds were tested as synergists for pyrethrum, nicotine, and rotenone. These tests were a continuation of studies made in previous years. No new compounds showed slight synergistic action when used with nicotine but not to a degree sufficient to warrant further exploration.

The hexahydrophthalates and cellosolves showed synergistic action with rotenone when used against aphids and house flies.

A satisfactory solution of rotenone for use against houseflies was accomplished with isopropyl alcohol, "Indasolvent", and kerosene. The problem of obtaining a solution of rotenone for use with house flies eliminated one of the main stumbling blocks in testing synergists against house flies.

R. L. Blickle
W. J. Morse

Forestry

Bark Removal from Cut Logs

Sample logs of poplar, birch, maple, hemlock, spruce and fir were cut and scored in several ways to promote bark loosening.

Scoring the bark was done by sawing, knife cutting, and ripping. It was found that a portable power circular saw could easily be used to make a length-wise cut through the bark and into the wood. A linoleum knife was useful in slitting the bark. A pulp hook had more ripping action than the other two and did a satisfactory job of scoring.

Results one year after cutting showed that in the case of red maple and balsam fir the bark was completely loosened. On paper birch it was loose several inches from the slit but tight otherwise.

Very little bark loosening has occurred on the other species.

The season of cutting appears to influence the degree of bark loosening, as red maple cut and scored during the growing season has a much higher percentage of loose bark one year later than that of logs of the same species cut and scored in the Fall.

L. C. Swain

Thinning White Pine Plantations By Bark Peeling

In order to maintain growth and quality in white pine plantations, it

is necessary to remove many of the crooked limby trees. The products of these trees are of no commercial value because of small size and poor form. Thus it is necessary to find cheap methods of thinning, if the job is to be done economically.

During the growing season bark may be peeled from trees quite easily. With this fact in mind, a peeling tool was designed for girdling standing trees. After experimentation it was found that the bark could be quickly peeled away from a portion of a tree trunk leaving an area of exposed wood averaging a foot or so in height.

One hundred limby crooked trees in a twenty-two year old plantation were girdled in this manner. It took an hour to do the peeling. No brushing out was necessary. The height of peeling was about four feet from the ground.

Fifty of the trees were treated on the barked area with 2, 4-D and 2, 4, 5-T, mixed with fuel oil. The mixture was applied with a force feed oil can. This chemical is commonly used to kill woody vegetation. The other fifty had no further treatment.

Results to date show that only those trees with the heaviest crowns among the chemically treated trees are still alive. Where only peeling was done, the smaller trees are dead, but it will take longer than one year for a complete kill.

In another area a sample of 100 tamarack trees was selected and girdled by peeling. No chemical was used in this instance.

The peeled wood surface has checked considerably and as in the case of pine, all of the smaller trees are dead. The larger trees have produced little new growth and considerable wilting is evident.

L. C. Swain

Horticulture

Conditions for Apple Root Growth Are Improved Greatly by Hay Mulch

Root studies on McIntosh apple trees grown for eight years in Paxton soil under hay mulch, sawdust mulch, and sod systems of culture, have shown a great deal of variability. Hay mulch produced a soil of dark color and granular structure down to the "C" horizon, thirty inches deep, and a dense mat of feeding roots extended down to that depth. Practically all roots were confined to the mulched area and extended only slightly beyond it. Where no fertilizer was used, the root patterns under sawdust mulch and sod systems of culture were similar. They were greatly reduced in number compared with those under hay mulch. Under the conditions of this experiment, sawdust mulch had no apparent effect on the texture of the soil under it.

During a comparatively dry summer the soil under sawdust mulch was near the wilting point for about one month. This is probably due to the fact that light summer rains failed to penetrate the six inches of sawdust. During that time, and in this particular year (1950), soil one foot deep under the sawdust mulch was drier than that under either the hay mulch or sod systems of culture. Available moisture in unmulched soil at three and twelve inches deep beyond the spread of the branches and mulch was below the wilting point for two months. Further experiments are under way to determine the effect of mulching trees beyond the spread of the branches.

R. Eggert

Effect of Biennial Bearing On Size and Yield of Fruit In the Northern Spy Apple

In a comparison of Northern Spy trees, which are strictly biennial in bearing habit, with those which have been producing crops of equal size from year to year, it was found that over a four-year period the regular bearing trees have produced a larger crop than have the biennial bearers. Furthermore, the annual bearing trees have produced better sized apples. The heavy load of fruit produced by the biennial bearing type causes considerable reduction in the size of the fruit.

L. P. Latimer

Effect of Hay Mulch on Northern Spy Apple Trees

Northern Spy trees mulched with hay, but not receiving any nitrogenous fertilizer, have outyielded those grown in sod and fertilized with nitrogen. When either phosphorus and potash, or phosphorus and potash plus nitrogen, are supplied to trees mulched with hay, the yield is depressed, the greatest depression in yield occuring with trees receiving the three elements nitrogen, phosphorus and potash.

L. P. Latimer

Leaf Scorch of Apple Trees

The prevention of leaf scorch, a physiological disorder, resulting from a deficiency of magnesium in the tree, is of economic importance in certain apple growing areas, particularly with respect to the McIntosh variety. The application of inorganic salts of magnesium to the soil, either by broadcasting them on the soil surface or by placing them in holes bored in the soil under and about the trees has failed to remedy this condition. On the other hand, it has been strikingly demonstrated that a surface mulch of hay placed under affected trees and out just beyond the spread of the branches will alleviate this leaf scorch. The improvement is gradual, the full effect not being realized until two or three years after first applying the mulch. The leaves of trees mulched with hay actually contain more magnesium than do those mulched with sawdust or those left unmulched.

L. P. Latimer

A New Apple Rootstock

Seeds of a species of apples — *Malus Sikkimensis* — from Skkim, India, were obtained from Dr. Karl Sax of the Arnold Arboretum, who suggested that it might have possibilities, judging from the behavior of a McIntosh tree growing on this stock at the Arboretum, as a dwarfing stock for apple varieties. Malus Sikkimensis seeds, being apomictic, produced a very uniform stand of seedlings. These seedlings were budded with the varieties McIntosh, Early McIntosh, Cortland, Northern Spy, Macoun, Golden Delicious, and are now in their third growing season. This stock is apparently quite vigorous in the nursery as first year whips were 5-6 feet long. The varieties grown on these seedlings seem to have unusual wide angle branches and show a tendency even in their third growing season to spread into a wide tree.

This rootstock has several good features in that it is apomictic — producing uniform seedlings, apparently hardy, it seems to be comparable with all varieties worked into it, and has a favorable influence on shape and size of the tree. A uniform rootstock produced from seed would be much less expensive than one that had to be propagated as from a stool bed.

Malus Toringoides — also obtained from Dr. Sax — is not as promising and is more difficult to handle in the nursery.

W. W. Smith

Figure 4. Seeds from Malus Sikkimensis produce a uniform stand of nursery trees when budded with commercial apple varieties.

Original McIntosh Propagated

The so-called "Red Sports" of McIntosh are not sports but variations from the original McIntosh. In fact, they are the original McIntosh unsported. The McIntosh apples in the commercial field that are low in red color and characteristically stripped are not the original McIntosh but are strains that have varied from the original McIntosh variety. The basis for this conclusion is that the original McIntosh tree, once removed, now growing at the McIntosh Farm at Dundela, Ontario, bears solid red apples, has hard firm flesh, and is of excellent quality. Scions from these trees were brought to our nursery and worked onto some of our rootstocks. These in turn produced the solid red apples that were very similar to the Red Strain now sold in this country as Red Strains of McIntosh. Comparing the different Red Strains with the original McIntosh, it is evident there is very little difference, but, if any, the original McIntosh, once removed, seems to be a little bit better than the Red Strains, so it is quite apparent that the so-called Red Strains of McIntosh are really the original McIntosh unsported, and that stripped and green McIntosh are the sports. There is not only a difference in color between strains but it is quite noticeable that the so-called red strains, which are more nearly like the original Macs, are a much harder apple and tend to have keeping quality that makes them hold up better in storage and on the market.

W. W. Smith

Phosphorus Absorption by Apple Trees from Foliar Sprays And Soil-Applied Phosphates

Radioactive phosphorus was added to five different salts of phosphorus which were then sprayed on approximately one-half the foliage of potted clonal apple trees. The work was carried out under closely controlled conditions.

Results show that phosphorus can be absorbed through foliage of these plants in large quantities, and that it is translocated to all other parts of the plants. It indicates that growers may be able to conserve large amounts of phosphorus fertilizers by spraying them directly on the foliage of plants instead of applying them to soils in which they are prevented from reaching plants because of fixation in an insoluble form.

This project is partly sponsored by a grant from the American Fertilizer Industries.

L. T. Kardos
R. E. Eggert

Techniques in Double Working Apple Trees

After observing the behavior of several varieties of apples double-worked on several stocks over a period of twelve years it becomes apparent that the varieties should be worked onto the scaffold branches of the body stock within eight to ten inches from the trunk and that the trees should be worked over all at one time. Varieties worked further out than eight inches on the branches often break down with the first crop of fruit. Allowing the body stock to form side branches on these scaffold branches next to the trunk has not strengthened them enough to hold up under production. When the branches are worked within eight inches of the trunk they seem to be strong enough to support future crops. When working the Hardy stock it has been noticed that if the top is worked over first and the bottom branches worked over later, the top will dominate the lower branches and they never do form useful branches. If the side branches are worked before the terminal, they often overgrow the terminal; then the center leader becomes too suppressed and finally dies. It appears that the best method is to work the whole tree at one time. It is better to let the tree go a year or two longer in the orchard before working it than to do it during two successive years. Whip-grafts make a very good union and in general are better than buds when double-working varieties onto hardy body stocks.

W. W. Smith

Organic Fungicides Have a Place in The Apple Scab Spray Schedule

Although organic fungicides have been available to New Hampshire fruit growers for several years, they have not been widely used because of cost, injury to the foliage, and, in some cases, injury to the operator. Tests completed during the year show that growers who have difficulty in obtaining scab-tree fruit could use to advantage one of the organic fungicides. The additional cost for the spray materials will be overcome by greater yields of marketable fruit, and if these materials are used in orchards where the trees are in good vigor, foliage injury is not important.

Phygon XL is an excellent protectant and four sprays with this material are equivalent to five sprays with a sulfur compound. This material will not eradicate the scab organism once infection has occurred. Under such conditions, the organic mercuries have excellent eradicative action and can be used up to five days after infection has taken place to burn out scab.

M. C. Richards

Reduce Help Needed To Operate The Hydraulic Sprayer

By constructing a series of foot operated levers from a barrel mounted on top of the spray tank to a shut-off valve in the pressure line it is possible for one man to control the spray from a boom at the back of a hydraulic machine. He can, at the same time, used a hand gun or broom to hit extra high tops, tips of limbs, or centers of trees not covered by the boom. With this very flexible arrangement we have been able to get excellent coverage, even with considerable breeze, and with quite a reduction in volume of spray material used.

R. Eggert

Frozen Applesauce Made By Processing Unpeeled Fruit Can Make An Attractive Commercial Product

Apples thoroughly washed and cleaned were cooked without peeling, and produced, after freezing, extremely attractive sauces, ranging in color from nearly clear white through buff, pineapple, pink, lavender, to deep red-purple. The color of the product was varied by blending varieties. The color produced by a specific variety remained constant and could be obtained at any time during the early part of storage.

Sauce stored without freezing developed the usual spots of concentrated color which made the product appear to be spoiled. Color broke down in a warm (70°F), dark storage. Sauce which was frozen in glass and held at 0°F for two months did not fade noticeably when placed in direct sunlight for one week at a room temperature of 70°F.

It would appear that displaying sauce of different colors in glass might greatly increase its attractiveness and sales, and would permit the buyer to select a product of high quality and color to harmonize with any color scheme carried out for the meal to be served.

R. Eggert

It Pays to Mulch Pear Trees

Hay mulch benefits young pear trees. This has been shown in a test started with two-year-old trees growing on a thin dry soil. Trees unmulched, but fertilized with nitrogen, have made little shoot growth and are very weak. Those mulched with hay, whether receiving nitrogen or not, have made good growth. The average annual shoot growth in 1950 was about ten times greater where hay mulch was used, regardless of whether or not they were fertilized with nitrogen. Young Clapp's Favorite trees mulched with hay bore a few fruits in 1950, whereas non-mulched pear trees have not yet produced fruit.

L. P. Latimer

Fertilizing Lowbush Blueberries

Fertilizing low bush blueberries will invigorate the bushes so that burning can be delayed one more year. In blueberry fields that have become devitalized to the extent that they have to be burned every other year in order to maintain production, fertilizers will invigorate the plants and keep them in production one or two years longer. This is an advantage because during the year of burning there is no crop — the area is out of production. We have been able, by the use of commercial fertilizer at the rate of 1,000 lbs. per acre, to keep a blueberry field in production for three consecutive years without burning, while the untreated areas have not produced a crop for the last two seasons. It would not be advisable to eliminate burning indefinitely because the stems of the blueberries become more branched every year and after four growing seasons they are so branched

that harvesting with a rake is very difficult. Also, diseases, insects, and weed plants will accumulate in the area. Often unfertilized blueberry fields that have not been burned for two years do not have enough plant growth in them to carry a fire. It then becomes necessary to use oil or hay to aid in burning. The use of fertilizer to stimulate the plants and keep them in production for another year not only makes the area more productive but also furnishes fuel for a good burn.

W. W. Smith

Forced Softwood Cuttings Speed Blueberry Propagation

Softwood cuttings of five varieties of cultivated blueberry placed in a propagating frame June 30, 1950, rooted well and were potted individually before November 20. Rather than to winter the small plants out of doors protected in a coldframe, as is common practice, part of them were kept in a heated greenhouse and not allowed to go into a dormant condition. A dilute solution of Ammonium Sulfate was used to water the plants once every two weeks. During the short winter days, supplemental light from 100-watt Mazda bulbs spaced every four feet over the greenhouse bench was provided so as to approximate fifteen and one half hours of daily illumination. Continuous growth was maintained until May 25, 1951, when the plants were set outside in the field.

At this time, ten forced plants of the Jersey variety had an average of 118 inches of total shoot growth per plant as contrasted with less than an average of four inches of shoot growth for plants wintered in the coldframe. Moreover, about one-half of the Jersey rooted cutting put in the coldframe were lost by winter injury. A similar favorable response was noted for forced cuttings of Concord, Rancocas, Stanley, and Pemberton.

The forced plants have been making some additional growth in the field since May 25, mostly as strong shoot growth from the base of the plants.

E. M. Meader

Toughness of Frozen Blueberries Not Influenced by Storing Them In Carbon Dioxide

Berries from five high bush varieties (Atlantic, Cabot, Concord, Rancocas, and Rubel) were harvested, packed in tin cans, and sealed at normal air pressure. Half of each lot was sealed in air and half in carbon dioxide. This was done to determine whether the toughness of fruit skins could be reduced by freezing the berries in carbon dioxide, and the effect of this gas on the quality of the fruit. Tests were repeated for two years, giving four lots of fruit on which tests were taken.

Fruit frozen in air was of superior quality both years, according to a panel of ten people who made the organoleptic tests.

Berries which had tough skins when they went into the cans were tough when they were removed, regardless of whether they were frozen in air or carbon dioxide. Fruit frozen in tin was superior to that frozen in pliofilm-cardboard containers. Skins of fruit removed from tin cans toughened excessively within five hours after removing from the cans and leaving the berries exposed to air.

R. Eggert

Korean Tree Berry, A New Hardy Raspberry

Plants grown from seeds of a Korean wild raspberry fruited for the first time at Durham in 1950. This raspberry, a selection of *Rubus*

morifolius, is being called Korean Tree Berry from a direct English translation of Korean words for this plant. The strong upright canes grow eight feet tall and withstood -17° F. in the winter of 1948-49, as well as the variable temperatures of the more mild open winters of 1949-50 and 1950-51. Plants have been rather free of diseases; a few seedling plants did have cane blight. Between four and five quarts of berries have been harvested from a single plant.

The red or orange, translucent, glossy berries have a distinctively sweet and characteristic flavor that differs from common American raspberries. Because of its hardiness, freedom from most raspberry diseases, vigor, and productivity, it is a useful new plant. Crosses have been made with red, black, and purple raspberries.

E. M. Meader
A. F. Yeager

Two New Raspberries

Two new red raspberries selected from the second generation of a cross between a Taylor Raspberry and (bakeberry) *Rubus Chamaemorus* have been given numbers for a trial distribution. No. 100 produces branching plants which grow about thirty inches in height; under our conditions it has been extremely productive and winter hardy. The fruits ripen early and are medium in size. No. 101 grows about four feet in height, is a large pointed red raspberry of very good quality, ripens in midseason, and is productive and hardy under local conditions. These two varieties were the only ones in a planting which included nearly all the more common cultivated sorts which produced crops in 1950.

A. F. Yeager

Using Geese To Weed Strawberry Fields

Three adult geese were allowed to range over half an acre of newly set strawberries from July to winter in 1950. They did not seriously disturb the berry plants. As weed eradicators, they were effective on grass and fair on red root and lambsquarter but did not eat purslane until after frost. In the summer of 1951, they were again pastured on newly set strawberries along with two goslings. The young geese did eat some runners and had to be removed.

A. F. Yeager

Three-Year-Old Korean Chestnut Trees Produce Nuts

Chestnuts from Korea were planted in the field in 1948. In the fall of 1950, the 6-foot high trees bore nuts at Durham, N. H., and the harvested nuts have been planted. A few American chestnut seedlings planted at the same time are not expected to fruit for several more years. Observations with respect to blight resistance on the Korean and American trees will be made from year to year. The Korean chestnuts as yet seem to be winter hardy.

E. M. Meader
A. F. Yeager

Bush Buttercup Squash

This is a new variety resulting from a cross between Buttercup and Zapillito, also called the Tree Squash. From this cross a baking squash of the Buttercup type has been purified. It is considerably earlier and in short seasons grows in bush form. This variety matures in a shorter time than any true squash of acceptable quality. It ripens its seed even in the one-hundred-day season of northern New Hampshire

A. F. Yeager

Cocheco Sweet Corn

A number of years ago seed of what is called the Fort Kent Flint corn was obtained from Northern New Hampshire. It is a variety that

will ripen its seed in one hundred days. It was crossed with Golden Gem sweet corn. From this the earliest yellow sweet corn of good size and shape was selected. It has now been purified and named Cocheco. There have been no extensive tests with the variety as yet. From observations made at Durham, N. H., it would appear to be earlier than any other sweet corn. It is a yellow eight-row variety resembling Golden Bantam in appearance, but not quite so good in quality.

A. F. Yeager

Green Snap Beans

Several strains of green snap beans with white seeds have been purified and distributed for trail. One of these, designated No. 57 at present, produces flat pods of unusual length. Seeds to be distributed are from plants that produced stringless pods not less than ten inches in length.

A. F. Yeager

New Early Horticultural Shell Bean Introduced

Appropriately named Shelleasy, this new variety has pods attractively mottled with red color. It is superior to the early-maturing Litteton variety, one of its parents, in this respect. Shelleasy is earlier than its other parent, the now popular Flash variety. Seed stock of the Shelleasy variety is being increased.

A. F. Yeager
E. M. Meader

Storing Butternut Squash

Experiments have been conducted for a number of years on the storage of Butternut squash. Some benefits have resulted from disinfection including the use of antibiotics, but not enough to justify a recommendation at this time.

Formaldehyde has shortened the storage period and increased the amount of shriveling. During the past two years, a material known as Latex VL 600, in which the squashes were dipped at harvest, has been beneficial, particularly as regards shriveling. From a warm dry storage on January 19, 1951, 68 per cent of the Butternut which had been dipped in 50 per cent VL 600 were still marketable. With a 20 per cent dip, 55 per cent were marketable. Where no dip was used, 42 per cent were marketable, and where formaldehyde was used, only 22 per cent were marketable.

A. F. Yeager

Ornamentals

Breeding Roses For Winter Hardiness

A large flowered climbing rose that is hardy without protection in most of New Hampshire and a bush rose of high quality whose branches do not kill back each winter would be desirable for landscaping. Toward these ends Betty Bland, a *R. Blanda* hybrid whose double pink flowers are borne on tall, nearly thornless, red canes of reliable hardiness, is being crossed with various roses of high quality. The first of the seedlings are being tested this year.

E. B. Risley

James MacFarlane Lilac

One of the projects with ornamentals at the University of New Hampshire has been to develop better late blooming varieties of lilacs. From this work a beautiful bright pink seedling which blooms two weeks later than ordinary lilacs has been

named James MacFarlane, in honor of the man who headed the floriculture work at the University of New Hampshire for so many years. This variety is a seedling of Loyalty, one of the Canadian varieties. We have found soft wood cuttings from it bloom in two years, producing a great quantity of blossoms. It makes an excellent landscape plant, and is also useful for cutting. It is being propagated as rapidly as possible and should be available at nurseries soon.

A. F. Yeager

New Varieties of Gladiolus

The gladiolus is well adapted to New Hampshire gardens and an effort is being made to improve the smaller flowered types which are more suitable for home decoration and florists' work than the larger types. More than 18,000 seedlings are being raised with the expectation of obtaining new varieties having superior spikes, productiveness, colors, and fragrance.

E. B. Risley

Winter Hardy Chrysanthemums Have Korean Wild Parentage

A wild single-flowered chrysanthemum from Korea has proved fully winter hardy at Durham, N. H. A pistallate-flowered seedling of the Korean species, *chrysanthemum sibiricum*, was enclosed in a screened cage along with such ordinarily rather hardy cultivated sorts as Nashua and Welcome, among others, for pollen parents. House flies were put into the screened cages and affected pollination readily. In addition, some hand pollinations were made. Several hundred seedlings from these crosses were planted in the field in June, 1950.

All seedlings having Korean X Nashua parentage survived the trying conditions of the winter of 1950-51. Welcome plants were winter killed, also a few of the seedlings from the cross with the Korean parent, but most of these proved fully hardy.

Further breeding work is anticipated utilizing selected first generation hybrid single-flowered plants to develop fully winter hardy double-flowered varieties for northern states.

E. M. Meader
E. B. Risley

Poultry Husbandry

Ammonia Vapor As a Source Of Ocular Disorder

During the past few years there has been an increasing incidence of a certain idiopathic disorder affecting young chickens. It has been suggested that ammonia vapor as commonly found in many brooder houses may be responsible for this ocular disorder.

Work was undertaken to determine whether this ocular disorder could be reproduced experimentally by subjecting chickens to ammonia vapor liberated from ammonium hydroxide. It was observed that an ocular disorder clinically resembling, if not identical to, naturally occurring cases of keratoconjunctivitis was reproduced experimentally, thus confirming the observations concerning the possible effects of ammonia liberated from the litter upon young chickens.

G. P. Faddoul
R. C. Ringrose

Breeding for Meat Type in Chickens

Ten years ago, the Poultry Department started to investigate the possibilities of using Cornish blood in producing better broilers. Dark Cornish males were crossed on New Hampshire females and a selection process for nine generations has produced families with good egg production, meat qualities, livability, hatchability, and uniformity. This new unofficial breed is called "Durhams." Some of the undesirable features of the Cornish such as slow growth, close feathering, and dark hairs are still evident, and its real value appears to be in crossing it back upon New Hampshires, as shown in the following broiler experiment which was run this past year:

Breed or Cross	*Pen. No.*	*Average Weight at 11 Weeks (in lbs.)* *Males*	*Females*	*Ave.*
Durhams	1	3.77	3.03	3.40
	2	3.43	2.83	3.16
New Hampshires	3	4.09	3.34	3.72
	4	4.13	3.34	3.74
Durham Male x New Hampshire female	5	4.12	3.21	3.66
	6	4.25	3.24	3.75

The crosses were considerably superior in weight when compared to the Durhams and were about equal to the straight New Hampshires. The cross retained a considerable share of the excellent breast qualities featured in the Durham, and were superior to the New Hampshires in this respect.

A white Cornish-New Hampshire cross now in its third generation of selection seems very promising. The plumage color varies from all white to buff and some have streaks of red and white. However, in all cases the undercolor is white. This new breed possesses an excellent breast width and has loose feathering, which are desirable features on today's market.

W. C. Skoglund

Does Washing Affect The Hatchability of Eggs?

There have been conflicting opinions concerning the various methods of egg washing and the effect on hatchability. Two types of mechanical washers were used in a study at the University Farm and the following conclusions were drawn: Clean eggs hatch better than dirty non-washed eggs. Washing dirty eggs improved their hatchability, but did not raise it to the level of clean eggs washed. Differences between the two types of washers were not significant. If used correctly, the various methods of washing eggs can involve considerable saving of labor and not affect hatchability.

W. C. Skoglund

Factors Influencing the Maturity Of Fall Hatched Pullets

In order to maintain a more even yearly egg production, fall hatching of chicks for replacement purposes is increasing in popularity. There is a widespread complaint that such pullets mature early and lay eggs of small size. One reason for the early sexual maturity and small egg size may be the effects of light stimulation. During late February, March, and April, the days are rapidly increasing in length as the fall hatched pullets are approaching sexual maturity. Thus there is a continuously increasing light stimulation. It was thought that perhaps by the use of lights, a uniform day could be estab-

lished and thus the possibility of stimulation removed. Recently special methods of feeding to delay maturity have been advocated.

In order to provide information on this problem, work was undertaken at this station with October hatched birds. Three pens of chicks were placed on our regular feeding program and three additional pens were placed on a special restricted feeding program. Within each feeding program a lighting experiment was set up. Daylight only, dim all-night light, and a fourteen-hour day by use of artificial lights were started with the day-old chicks. Thus, the pens receiving only daylight were subjected to light stimulation due to increasing length of day while the other pens had a constant level of light. Preliminary reports indicate that the feeding program did not influence age at sexual maturity or egg size. On the other hand, the lights had the desired effect of delaying maturity and increasing egg size.

Utilizing Pasture to Save Feed Costs In Rearing Pullets

In order to determine the value of pasture in rearing pullets, one experimental plot of grasses was used to rear a group of pullets on an *ad libitum* feeding program. On another plot limited feeding was practiced. The character of the feed was shifted from about 1.2 of grain to one of pellets in the ad libitum feeding to 3.4 of grain to one of pellets in the limited feeding. This resulted in a feed cost saving of four dollars per ton. The pullets on the limited feeding program averaged about two tenths of a pound less in weight at twenty weeks of age. This was primarily due to the lack of pasturage because of dry weather. When a good range is available it is possible to rear good pullets at a saving by limiting feed, particularly mash.

R. C. Ringrose

Soils

A Survey of the Soils Of New Hampshire

During the past year, an additional 50 square miles were mapped in Rockingham County. There still remains to be completed about 100 square miles in the northwestern part of the county.

Because 83 per cent of the state is forested, there was an attempt made this past year to make the soil survey information more useful to foresters. The soils of the seven counties for which maps are available were grouped on the basis of long-time forest management needs and colored maps were prepared, showing the location of the various soil groups. These maps were then given to the county foresters. A two-day school was held for the county foresters, and field trips have been made to study forest soil problems.

Numerous requests for information about the soils on specific tracts of land have been answered, and copies of the published soil survey maps have been sent out.

A generalized map of the soils of the state has been prepared. Photographed copies are available.

W. Lyford
R. Feuer

Legume Persistence Affected by Soil Type

Field plots have been established on three soil types to study the inherent effect of soil type on the persistence of perennial legumes. Both the physical and chemical properties are being allowed to contribute to

the picture of persistence by using only minimal levels of the major nutrients.

During 1950, the droughtiness of the Stratham gravelly loam soil at Greenland expressed itself forcefully by causing almost a complete loss of the seeding of all four of the legumes used: alfalfa, ladino clover, red clover (a perennial strain), and birdsfoot trefoil. The alfalfa persisted best under the severe drought and trefoil was a poor second.

The same plantings of legumes made on a Paxton loam at Northwood Ridge also suffered from the drought, but ladino and red clover showed up more favorably because of the better moisture supply which the Paxton loam afforded.

L. T. Kardos
P. T. Blood

Proper Width and Slope of Beds For Draining Whately and Biddeford Soils

Open V-shaped drainage ditches were constructed in 1950 to drain an 80-acre field on the University farm.

Most of the ditches were 100 feet apart but, because there is some question whether this is the best distance, "beds" that are 75, 100, and 200 feet wide were made for experimental purposes. Height of ground water on these beds have been measured at intervals during the past year, and yield data of the hay growing on these plots is being obtained.

Water table studies show that the water that falls on the 200-foot plot is not removed nearly as rapidly as on the 75- and 100-foot plots. Water ponded on the surface of the 200-foot plot and killed out the clovers in many places. Both the 75- and 100-foot plots had a good stand of clover in contrast to the 200-foot plot. Yield data are not yet available but, on the basis of observation alone. it is fairly certain that the yields on the 200-foot plot will be less.

The initial cost of constructing the large plot was greater than for constructing two individual 100-foot plots. This, and the fact that water is removed less readily and yields are lower, are sufficient to allow us to make a statement that 200-foot beds are too wide. The 75-foot bed, at present, seems to have no particular advantage over the 100-foot bed.

W. Lyford

Rotted Sawdust Shows Promise in Soil Improvement

Tests with corn on field plots using treatments of fresh sawdust and rotted sawdust, compared to manure and plots with no organic matter added, have shown best yields with rotted sawdust over a three-year period. Each plot received an equal amount of commercial fertilizer. For two of the three seasons the fresh sawdust plots gave lowest yields of all.

Composting of fresh sawdust may be done fairly rapidly with mixtures of it with poultry manure or with the latter plus fresh chopped vegetation. Such mixtures after thorough decomposition have produced crops in greenhouse pot cultures which outyielded control plants growing in good potting soil. High moisture and fairly high temperatures are important factors in rapid composting.

S. Dunn
L. P. Wolfe, Jr.
W. MacDonald

Soil Types Vary in Their Potassium Supplying Power

Chemical studies made on twelve of the principal soil types in New Hampshire indicate that under virgin conditions the soils vary considerably in their ability to release potassium from their relatively insoluble reserve supply. In general, the soils de-

veloped on mica schist parent materials were capable of releasing over twice as much potash as the soils developed on granitic till, 495 lbs. potassium as against 220 lbs. potassium for the combined A and B horizons.

The soils developed on mica schist till also had more readily available exchangeable potash than did the granitic soils. The granitic group of soils, Gloucester and Essex, had an average content of 55 pounds of exchangeable potassium while the mica schist group, Paxton and Charlton, had 75 pounds of exchangeable potassium. In neither case would the quantity of potassium be regarded as adequate for good growth.

The study further indicated that when large amounts of potash fertilizers are added to a soil in long-time potato fertilization, considerable quantities of the potash accumulate as the exchangeable form and as a relatively insoluble reserve supply. For example, one potato-soil which had been fertilized annually for 15 years contained 664 pounds of exchangeable potassium and 1,133 pounds of reserve supply potassium. A sample taken nearby in adjacent woodland contained only 114 pounds of exchangeable potassium and 463 pounds of reserve supply potassium. Thus there was an apparent net accumulation of 1,222 pounds of potassium in these two forms.

L. T. Kardos
P. T. Blood
R. Feuer

Weed Control

Japanese-Bamboo Can Be Controlled With the New Brush-Killer Herbicides

Japanese-bamboo or Japanese Knotweed is one of our most troublesome weeds around houses and buildings and it has been one of the hardest to control. Experiments carried out during the past two years demonstrate that three applications of equal mixtures of 2,4-D and 2,4,5-T, known as brush killers, will destroy most of the root systems as well as shoots. The same concentration recommended for foliage treatment of woody plants was used or 1½ parts of 2,4-D and 1½ parts of 2,4,5-T per 1000 parts of water. The first application was made in early summer followed by a second application immediately after new growth had occurred. The third treatment was made the following spring. A few scattered and much weakened shoots still sprouted which have had to be treated individually to prevent any revival of the weed.

A. R. Hodgdon

Recent Developments in Quackgrass Control With TCA

During the past two years our experiments have been directed to finding out the most suitable concentrations and conditions for application of TCA. Without exception we have obtained the most satisfactory controls at low concentrations with the midsummer applications. This was noted in 1949 and again more strikingly in 1950. These were both very dry and hot summers, particularly in late July when the most effective treatments were made. In midsummer, provided the weather is hot and dry, Quackgrass can be killed completely by applications of no more than fifty pounds of 90 percent Sodium TCA per acre. We recommend also cutting the grass before applications of the chemical. Probably considerably lighter applications would be effective if followed in a week or ten days by harrowing or plowing of the treated area to disturb the grass-rhizomes.

A. R. Hodgdon

Figure 5. The area in the foreground between the stakes of this quackgrass plot was treated with sodium TCA, 50 lbs. per acre, on July 26, 1951, during hot and very dry weather. Other annual weeds have been removed to show few remaining plants of grass.

Selective Herbicides for Weed Control

Controlling weeds with hormones and chemicals, sprays which are selective, is now an accomplished fact. The use of 2,4-D, at once a hormone and a selective herbicide, is quite commonly practiced in oat and corn fields. Di-Nitro compounds, too, have been successfully used for weed control.

Experiments with both these substances are under way in New Hampshire. 2,4-D has been used very effectively in spraying oats, to control the most common weeds in oat fields, which include usually some kind of mustard (kale or charlock) and white pigweed *(Chenopodium album)*.

In spraying oats, one of the problems involved is to spray with such a low amount of chemical that the stand of clovers or alfalfa is not affected. In our tests, the weeds mentioned above are fairly well controlled with one-half pint of 40 per cent 2,4-D acid per acre. One pint of 40 per cent 2,4-D acid, which, of course, controlled weeds and allowed the oats to surge ahead, was not lethal to red and ladino clovers.

Alfalfa is more easily affected by 2,4-D than are the clovers. For that reasons, a di-nitro compound may be preferable to use in spraying oats which contain an alfalfa seeding. Trials with this substance in 1950 indicated that the clovers were less resistant to di-nitro than 2,4-D. The type of sprayer to use for di-nitro is different than for 2,4-D, the latter being best applied with a low gallonage-low pressure outfit, while di-nitro compounds should be applied with a sprayer that will put on at least 100

gallons of spray material per acre.

After three years of weed control experiments in corn fields, our advice is not to throw the cultivator away, although it has been found that a 2,4-D application can be effectively substituted for one or more cultivations.

A pre-emergence spray at one to one and one-half pounds of 2,4-D acid per acre applied just about the the time the corn is coming up (6-8 days after planting) is effective in controlling most weeds, and may eliminate one or more cultivations at the beginning of the season. Spraying at lighter rates, one-half pound of 2,4-D acid per acre, will not materially damage the corn while growing. Such an application is useful in controlling susceptible weeds in drilled corn, even after the corn is 12 to 18 inches high.

In our experiments, we have been dealing with corn fields that carried a varied weed population, some of which were not particularly susceptible to injury by 2,4-D. For this reason, plots which were not cultivated but sprayed exclusively with 2,4-D had as thick a weed growth and the corn was almost as poor as on those plots where no spraying or cultivation had been done. The weed population, however, was entirely different. Quick growing tall weeds like mustard and pigweed were in the ascendancy on the unsprayed, uncultivated plots, while red rooted pigweed (*Amaranthus retroflxus*) and smart weed (particularly *Polygonum Pennsylvanicum*) were just as abundant on the sprayed uncultivated plots.

There are many factors that influence the effectiveness of 2,4-D.

Figure 6. This quackgrass plot was treated with sodium TCA, 50 lbs. per acre, on September 7, 1950, during cool weather. Precipitation was heavy during the preceding month.

Temperature at time of application is paramount, the substance being much more effective at temperatures about 65°F. Soil type, humidity, time of day, and other factors also influence its effectiveness. With both these substances, directions on the package should be carefully followed to obtain best results.

F. S. Prince
P. T. Blood

Other Active Projects

BY DEPARTMENTS

Agricultural Economics

Acquiring Farm Capital. *W. K. Burkett.*
Dairy Cost Reduction. *W. K. Burkett.*
Farm Management Problems of Potato Production in New Hampshire. *W. K. Burkett.*
Management Problems in the Use of Mow Hay Driers. *J. C. Holmes.*
Marketing New Hampshire Potatoes. *J. R. Bowring.*
Marketing Mixed Grain Feed. *H. C. Woodworth.*
Utilization of Good Agricultural Resources. *W. K. Burkett.*

Agricultural and Biological Chemistry

Carbohydrates of Pasture Grasses. *T. G. Phillips, M. E. Laughlin.*

Agronomy

Fertility Needs of Ladino Clover. *F. S. Prince, P. T. Blood, L. T. Kardos.*
Methods for Controlling Erosion of New Hampshire Potato Fields. *L. T. Kardos.*

Bacteriology

Diagnosis and Control of Vibriosis in New Hampshire Dairy Herds. *A. F. Howe, S. N. Schroeder, L. W. Slanetz.*
Studies on the Bacteria in the Rumen of Dairy Animals. *A. F. Howe, W. E. C. Moore, L. W. Slanetz.*

Botany

Flora of New Hampshire. *A. R. Hodgdon.*
Testing Tomato Varieties for Resistance to Late Blight. *M. C. Richards.*

Dairy Husbandry

Influence of Herd Management on Milk Production, Efficiency of Reproduction, and Herd Replacement Maintenance. *K. S. Morrow.*

Entomology

Insect Records. *J. G. Conklin.*
Control of Apple Maggot. *J. G. Conklin.*
Studies on Forest Insects. *J. G. Conklin.*

Horticulture

Lettuce Tipburn Experiments. *L. P. Latimer.*
Bark Mulching for Apple Trees. *L. P. Latimer.*
Value of Bark as a Mulch for Small Fruits. *W. W. Smith.*
Temperature Relations of Fruit Plants. *L. P. Latimer, R. Eggert.*

State Service

Avian Respiratory Disease Research

In order to initiate a research program on respiratory diseases, various isolations from specimens submitted to the poultry diagnostic laboratory have been obtained and filed in a library for experimental use. The specimens have been obtained from all parts of the state. During the period of January 1, 1951, to June 30, 1951, the following isolations have been made: 11 of Newcastle Disease and 10 of Infectious Bronchitis.

W. R. Dunlop

Diagnostic Service of The Poultry Laboratory

A total of 10,117 specimens of all kinds was submitted to the Poultry laboratory during the two years from July 1, 1949, to June 30, 1951. These represented 3,445 cases. 9,104 chicken specimens, 496 turkeys, and 38 miscellaneous birds were examined. 148 specimens from animals other than birds were handled at the laboratory.

A summary of the tabulation of chicken and turkey cases follows:

	Number of Diagnoses		*Number of Specimens*	
	1949-50	1950-51	1949-50	1950-51
Adult Chickens	781	686	1,685	1,465
Chickens (4 months or under)	636	707	2,996	2,958
Adult Turkeys	22	24	43	42
Turkey Poults	72	40	293	118
Miscellaneous birds	6	14	16	22
Blood Samples for Immunity Tests	122	209		

Infectious Bronchitis			Newcastle Disease		
	1949-50	*1950-51*		*1949-50*	*1950-51*
Susceptible	38	69	Susceptible	87	148
Immune	50	97	Immune	43	59
Suspicious	4	8	Suspicious	2	2

F. E. Allen, A. C. Corbett,
G. P. Faddoul, W. R. Dunlop

Differential Diagnosis Of Newcastle Disease

The hemagglutination-inhibition test was performed on pooled serum obtained from all pullorum samples submitted to this laboratory. During the past two years 1,918 such tests have been completed. 1,276 of the serum samples were positive, which indicates that the birds have been vaccinated or have experienced Newcastle disease. 642 were found to be susceptible. The results indicate that the poultrymen of New Hampshire are aware of the necessity of adopting a Newcastle vaccination program.

In much the same manner, serum neutralization tests for infectious bronchitis were applied to various pooled samples. During the 2-year period, 390 serum neutralization tests were run and of these 238 were found positive, indicating that they had experienced infectious bronchitis.

W. R. Dunlop
A. C. Corbett

Infectious Bronchitis Vaccine

Commercial vaccines for prevention of infectious bronchitis of poultry are not being manufactured due to federal regulations against interstate shipment. For this reason, the poultry laboratory produces bronchitis virus for the poultrymen of the state. This material is produced in embryonating eggs and packaged in lots of sufficient quantity each for a flock inoculation. It is held frozen at approximately -10°F. During the period from July 1, 1949 to June 30, 1951, 1,768 lots have been supplied to New Hampshire flocks.

A. C. Corbett
G. P. Faddoul
W. R. Dunlop

Pullorum Testing

The Poultry Laboratory at the University of New Hampshire cooperates with the State Board of Agriculture in testing poultry for Pullorum Disease. The record for the past two years follows:

	1949-50	*1950-51*
Number of Flocks Tested	683.0	656.0
Birds Tested	1,697,407.0	1,601,000.0
Retests	89,255.0	96,328.0
Total Samples Tested	1,786,642.0	1,697,328.0
Number of Reacting Flocks	6.0	4.0
Number of Reactors (Birds)	200.0	62.0
Percentage of Reactors	.0118	.0038

F. E. Allen
A. C. Corbett
W. R. Dunlop

The National Poultry Improvement Plan

A total of 47 states are cooperating with the United States Department of Agriculture in administrating the National Poultry Improvement Plan. In New Hampshire, a board of the poultrymen administer the plan with the cooperation of the University of New Hampshire, the Agricultural Experiment Station, and the State Deparment of Agriculture.

The breed improvement stages of the plan are administered by personnel of the University of New Hampshire, Department of Poultry Husbandry. The scope of the work is indicated by the following table:

	1949-50	*1950-51*
Number of Flock Inspections	320	495
Number of Birds	981,367	1,272,635
Number of Hatchery Inspections	42	40
Number of R.O.P. Flocks	11	10
Number of R.O.P. Birds	8,287	7,335
NPIP Meat Program (Farms)	0	5

The NPIP Meat Program is an attempt to evaluate the meat qualities of different strains and breeds of birds. Of the 10 flocks participating in the United States, New Hampshire has half of them. This program measures egg production of the parent strain, as well as meat qualities at broiler age. It has led to the establishment of the First New Hampshire Broiler Test where the chicks from the five participating breeders

and seven other breeders are being raised to 10 weeks of age under similar environmental conditions.

E. T. Bardwell
C. F. Zoerb

Inspection of Fertilizers And Feedingstuffs

In accordance with the laws regulating the sale of commercial fertilizers and of concentrated commercial feedingstuffs, 203 brands of fertilizers and 1,069 brands of feedingstuffs were analyzed for the State Department of Agriculture during the biennium.

Cooperation in work on analytical methods with the American Association of Feed Control Officials, the Smalley Foundation and the Association of Official Agricultural Chemists has been continued.

Samples of feeds, fertilizers, and other materials have been analyzed for residents of the state. Seventy-one such samples have been examined.

For the nutrition laboratory of the Experiment Station, 423 samples were analyzed, and for the Botany Department, 40 samples.

H. A. Davis

Soil Samples

Samples of soil tested for residents of the state totalled 5,056.

D. Josselyn

Seed Inspection

The regular seed inspection work for the State Department of Agriculture was conducted as usual. During the year 2,531 samples were handled in the laboratory. Of this number, 683 were collected by the State Inspectors and will be reported in Bulletin 390; 1,848 samples were sent in by seed dealers and farmers in compliance with the seed law which requires that all vegetable and agricultural seeds must have been tested for germination within nine months of being offered for sale, and therefore, much of the seed tested was from that carried over by retail stores from the previous season, but a large number of samples were received from farmers who had grown beans, corn, melons, or squash which they wished to sell as seed.

Two general referee samples were received and run, and three regional referee samples were prepared and sent out from this laboratory to the fourteen laboratories in the Northeast comprising this region.

B. G. Sanborn

Mastitis Testing Service

A total of 2,708 quarter samples of milk submitted by New Hampshire dairymen or veterinarians were tested for the diagnosis of bovine mastitis during the fiscal year 1949-50. This represents samples from 677 cows and charges were made at the rate of 25 cents per cow for this service.

During the fiscal year 1950-51, 2,868 quarter samples (717 cows) were tested for mastitis. The charges made for this service were increased from 25 cents per cow to one dollar per cow beginning January 1, 1951. Samples from 300 cows were tested during the period January 1, to July 1, 1951. Since it is no longer possible to continue this service as a part of our research program, the dairymen and veterinarians have been informed that after July 1, 1951, the Bacteriology Department at the University of New Hampshire could no longer provide facilities for the laboratory diagnosis of mastitis. It will be necessary to establish it on a separate basis subsidized entirely by funds obtained from charges made to the dairymen or funds from other sources. This problem was discussed at the meeting of the Granite State Dairymen's Association held in Durham in April, 1951, and a committee was appointed to study the problem and make recommendations.

L. W. Slanetz

PUBLICATIONS

Experiment Station Bulletins

377 Inspection of Commercial Feedingstuffs. *H. A. Davis, S. H. Roseman* and *T. O. Smith.*
378 Results of Seed Tests for 1949. *Bessie G. Sanborn.*
379 Inspection of Commercial Fertilizers. *H. A. Davis, S. H. Roseman* and *T. O. Smith.*
380 Breeding Improved Horticultural Plants. I. Vegetables. *A. F. Yeager.*
381 Inspection of Commercial Feedingstuffs. *H. A. Davis* and *R. E. Kramer.*
382 Annual Report of the Director of the New Hampshire Agricultural Experiment Station. *Robert F. Chandler, Jr.*
383 Breeding Improved Horticultural Plants. II. Fruits, Nuts and Ornamentals. *A. F. Yeager.*
384 Results of Seed Tests for 1950. *Bessie G. Sanborn.*
385 Inspection of Commercial Fertilizers. *H. A. Davis, R. E. Kramer* and *M. A. Bruce.*
386 Marketing New Hampshire Potatoes. *J. R. Bowring.*

Circulars

80 Efficient Dairy Chore Practices. Part III. The Problem of Slow-Milking Cows. *Harry C. Woodworth, Kenneth S. Morrow* and *Earl M. Elliott.*
81 Pasture Management Investigations. *Ford S. Prince* and *Paul T. Blood.*
82 The Animal Metabolism Laboratory at the University of New Hampshire.

Research Mimeographs

Agricultural Economics

5 A Description of Mow Hay Driers on 23 New Hampshire Dairy Farms in 1948. *John C. Holmes.*
6 Milk Marketing in Small Towns. *J. R. Bowring* and *J. C. Holmes.*
7 Management Problems Associated with Mow Drying of Hay on Five Farms. *John C. Holmes.*
8 Progress Report on Harvesting and Marketing Cucumbers for Pickles Under Contract. *H. C. Woodworth.*
9 Potato Quality at the Retail Level in New Hampshire. *J. R. Bowring.*

Dairy Husbandry

1 Experiences with a Trench Silo. *H. A. Keener* and *N. F. Colovos.*

Other Scientific Publications

Conklin, J. G., and Walker, G. I. *Parathion in Early Spring Applications for Bud Moth Control.* Jour. Economic Ent. 42: 153-154. 1949.

Teeri, A. E., Leavitt, M., Josselyn, D., Colovos, N. F., and Keener, H. A. *The Effect of Sulfathalidine on the Excretion of Vitamin B by Ruminants.* Jour. Biol. Chem. 182: 509-514. 1950.

Colovos, N. F., Keener, H. A., Prescott, J. R., and Teeri, A. E. *The Nutritive Value of Timothy Hay at Different Stages of Maturity as Compared with Second Cutting Clover Hay.* Jour. Dairy Sci. 32: 659-664. 1949.

Prince, F. S., and Blood, P. T. *Blanket Indigo.* Agron. Jour. 41: 1949.

Colovos, N. F., Keener, H. A., Prescott, J. R. and Teeri, A. E., *The Nutritive Value of Wood Molasses as Compared With Cane Molasses.* Jour. Dairy Sci. 32: 907-913. 1949.

Keener, H. A., Percival, G. P., Ellis, G. H., and Beeson, K. C. *A Study of the Function of Cobalt in the Nutrition of Sheep.* Jour. Animal Sci. 9: 404-413. 1950.

Moore, H. C., and Teeri, A. E. *Relationship of Composition of Milk to Methods Used for Determining Adulteration.* Jour. Milk and Food Tech. 13: 203-205. 1950.

Hodgdon, A. R. *Is Onoclea Sensibilis Poisonous to Horses?* American Fern Jour. 41: 1951.

Hodgdon, A. R. *A New Form of Rubus Allegheniensis Rhodora.* No. 625. Jan. 1950.

Faddoul, G. P., and Ringrose, R. C. *Avian Keratoconjunctivitis.* Vet. Med. 45: 1950.

Teeri, A. E., Josselyn, D., Colovos, N. F., and Keener, H. A. *Effects of Method of Preservation of Roughage, and of Cane or Wood Molasses on Vitamin Excretion by Cows.* Jour. Dairy Sci. 34: 299-302.

Keener, H. A., Baldwin, R. R., and Percival, G. P. *Cobalt Metabolism Studies with Sheep.* Jour. Animal Sci. 10: 1951.
Slanetz, L. W., and Allen, F. E. *Aureomycin in the Treatment of Bovine Mastitis.* Jour. American Vet. Med. Assoc. 117: 392-395. 1950.

CHANGES IN PERSONNEL

Adams, Harold W., Assistant Editor for Agriculture and Home Economics. (July 5, 1949-)
Bartlett, John B., Assistant Agronomist. (Feb. 1, 1949-Sept. 6, 1949)
Batchelder, Bradford, Jr., Assistant in Research (Agr. Eng.) (Nov. 1, 1950-June 30, 1951)
Bowles, Mrs. Ella S., Publications Editor. (October 14, 1943-June 30, 1951)
Bruce, Mrs. Mary A., Assistant in Agricultural and Biological Chemistry. (July 1, 1950-June 30, 1951)
Chandler, Robert F., Jr., Director. (September 1, 1947-October 31, 1950)
Dunlop, William R., Assistant Poultry Pathologist. (August 28, 1950-)
Eastman, Charles E., Graduate Assistant in Agronomy. (July 1, 1950-)
Eastman, M. Gale, Research Assistant in the Agricultural Experiment Station. (January 1, 1950-)
Faddoul, George P., Assistant Poultry Pathologist. (Feb. 16, 1948-July 31, 1950)
Fox, Arthur G., Assistant Agricultural Engineer. (Sept. 1, 1949-)
Goodman, Robert, Graduate Assistant in Horticulture. (Sept. 1, 1948-June 30, 1950)
Harwood, Wilfred T., Assistant in Charge of Plant and Animal Sciences Library. (Oct. 23, 1944-June 30, 1951)
Hess, Carl W., Poultry Geneticist. (July 1, 1947-Nov. 19, 1949)
Howe, Arthur F., Assistant Bacteriologist. (Sept. 1, 1949-Jan. 31, 1951)
Jack, Charles, Graduate Assistant in Horticulture. (Oct. 1, 1949-June 30, 1950)
Kilik, Alice, Research Assistant in Bacteriology. (Feb. 5, 1951-June 30, 1951)
Kramer, Roslyn E., Laboratory Assistant in Agricultural and Biological Chemistry. (Sept. 6, 1949-June 30, 1950)
LaChance, Mrs. Virginia, Laboratory Technician in Poultry Husbandry. (July 1, 1948-May 12, 1951)

NEW HAMPSHIRE AGRICULTURAL EXPERIMENT STATION

June 30, 1951

ADMINISTRATION

Harold C. Grinnell, PhD., Director
Mathias C. Richards, PhD., Associate Director
Russell C. Smith, Purchasing Agent
Walton E. Devine, Assistant Treasurer
Ella S. Bowles, Publications Editor
Harold Adams, B.S., Assistant Editor for Agr. & Home Economics
Thelma Brackett, A.B., Librarian
Wilfred T. Harwood, Library Assistant in Charge, Plant and Animal Sciences Library

AGRICULTURAL AND BIOLOGICAL CHEMISTRY

Thomas G. Phillips, PhD., Chemist
Stanley R. Shimer, M.S., Associate Chemist
Gordon P. Percival, M.S., Associate Chemist
Helen P. Shimer, PhD., Associate Chemist
Arthur E. Teeri, PhD., Associate Chemist
Henry A. Davis, M.S., Assistant Chemist
Margaret Loughlin, A.B., Assistant in Agricultural and Biological Chemistry
Dorothy Josselyn, Assistant in Agricultural and Biological Chemistry
Mary A. Bruce, B.S., Assistant in Agricultural and Biological Chemistry

AGRICULTURAL ECONOMICS

Harry C. Woodworth, M.S., Agricultural Economist
Winfred K. Burkett, PhD., Associate Economist
James R. Bowring, PhD., Associate Agricultural Economist
Lawrence A. Dougherty, B.S., Assistant Agricultural Economist
John C. Holmes, A.B., Research Assistant in Agricultural Economics

AGRICULTURAL ENGINEERING

Bernard C. Rines, BSAE and E.E., Associate Agricultural Engineer
Arthur G. Fox, Jr., BSAE, Assistant Agricultural Engineer
Bradford Batchelder, Jr., B.S., Assistant in Research in Agricultural Engineering

AGRONOMY

Ford S. Prince, B.S., Agronomist
Leroy J. Higgins, B.S., Associate Agronomist
Louis T. Kardos, PhD., Associate Agronomist
Paul T. Blood, M.S., Assistant Agronomist
*Reeshon Feuer, B.S., Soil Survey Assistant
Bessie G. Sanborn, Seed Analyst
Walter Lyford, M.S., Soil Surveyor
Charles E. Eastman, B.S., Graduate Assistant
George R. Moore, B.S., Graduate Assistant

BACTERIOLOGY

Lawrence W. Slanetz, PhD., Bacteriologist
Fred E. Allen, D.V.M., Veterinarian
Harriet Reynolds, M.S., Assistant Bacteriologist
Alice Kilik, B.A., Research Assistant in Bacteriology
Agnes T. Richardson, B.S., Laboratory Assistant
Sherwood Schreoder, B.S., Graduate Assistant in Bacteriology
Francis M. Sirotnak, B.S., Graduate Assistant in Bacteriology
W. E. C. Moore, B.S., Graduate Assistant in Bacteriology
James F. McConnell, B.S., Department Technician

BOTANY

Albion R. Hodgdon, PhD., Plant Taxonomist
Stuart Dunn, PhD., Plant Physiologist
Mathias C. Richards, PhD., Plant Pathologist
Charlotte G. Nast, PhD., Plant Cytologist
William MacDonald, B.S., Research Assistant in Botany
Douglas Murphy, B.S., Research Assistant in Botany

DAIRY HUSBANDRY

Kenneth S. Morrow, M.S., Dairy Husbandman
Harry A. Keener, PhD., Dairy Husbandman
Herbert C. Moore, M.S., Associate Dairy Husbandman
N. F. Colovos, M.S., Associate Animal Nutritionist
A. D. Littlehale, Herdsman

ENTOMOLOGY

James G. Conklin, PhD., Entomologist
Robert L. Blickle, PhD., Associate Entomologist
Wallace J. Morse, B.S., Research Chemical Assistant in Entomology

FORESTRY

Clark L. Stevens, PhD., Forester
Lewis C. Swain, M.F., Associate Forester

HOME ECONOMICS

Frances Platts, M.Ed., Research Assistant in Home Economics

HORTICULTURE

Albert F. Yeager, PhD., Horticulturist
Elwyn M. Meader, M.S., Associate Horticulturist
L. Phelps Latimer, PhD., Associate Horticulturist
William W. Smith, PhD., Associate Horticulturist
Russell Eggert, M.S., Supt. Horticultural Farm
Edward B. Risley, B.S., Greenhouse Supt.
M. Gale Eastman, PhD., Research Assistant
Robert W. Paulson, B.S., Graduate Assistant
R. Dee Smith, B.S., Graduate Assistant

POULTRY HUSBANDRY

Winthrop C. Skoglund, M.S., Poultry Husbandman
Richard Ringrose, PhD., Associate Poultry Husbandman
Fred E. Allen, D.V.M., Veterinarian
Alan C. Corbett, D.V.M., Pathologist
William R. Dunlop, PhD., Assistant Poultry Pathologist
E. T. Bardwell, R.O.P. Supervisor
C. F. Zoerb, Poultry Inspector
Richard Ford, Supervising Technician in Poultry Lab.
Donald S. Cross, Senior Laboratory Technician in Poultry Husbandry
Kathryn Moore, Assistant Laboratory Technician in Poultry Husbandry
Carl R. Lude, B.S., Laboratory Technician in Poultry Husbandry

*On Leave of Absence

EXPENDITURES FOR THE FISCAL YEAR ENDING JUNE 30, 1950

	Hatch	Adams	Purnell	B-Jones	Research and Marketing 9(b)1-9(b)2	9(b)3	Supplementing
Personal Services	$12,708.24	$13,272.34	$51,747.88	$8,543.18	$23,987.70	$2,928.27	$37,142.71
Travel	126.73	5.00	1,127.75	413.08	968.84	40.96	2,819.10
Transportation of Things	17.35	33.20	42.18	5.56	2.47		89.48
Communication Service	388.53	56.30	31.42	4.35	7.30	.10	445.21
Rents and Utility Services	1,100.00		178.00		10.00	395.00	73.00
Printing and Binding	186.45		509.60	12.30	24.80		186.33
Other Contractual Services	.55	30.64	232.37	14.63	54.96	380.35	382.61
Supplies and Materials	322.15	1,096.52	2,827.58	382.65	903.67	356.28	5,598.14
Equipment	150.00	506.00	3,303.22	549.55	1,142.24	199.04	6,897.74
Totals	$15,000.00	$15,000.00	$60,000.00	$9,925.30	$27,101.98	$4,300.00	$53,634.32

Income for Supplement Expenditures:	
State Money Offsetting Federal Funds	$37,027.28
State Money for Station	6,508.44
Research Sales	10,098.60
	$53,634.32

EXPENDITURES FOR THE FISCAL YEAR ENDING JUNE 30, 1951

	Hatch	Adams	Purnell	B-Jones	Research and Marketing 9(b)1-9(b)2	9(b)3	Supplementing
Personal Service	$12,540.02	$13,730.35	$49,802.61	$9,105.23	$25,629.44	$2,900.00	$39,551.50
Travel		34.08	1,428.22	98.28	86.85		4,120.61
Transportation of Things		37.04	58.13	6.01	8.48		101.43
Communication Service	577.86	40.50	41.23	.35	8.60		134.06
Rents and Utility Services	1,100.00		198.00		6.00	395.00	
Printing and Binding	150.20		24.00		43.05		1,425.95
Other Contractual Services	43.75	28.85	1,279.11	16.80	83.55	185.72	2,015.00
Supplies and Materials	50.56	601.40	4,388.88	259.85	909.92	819.28	4,465.38
Equipment	537.61	527.78	2,779.82	438.78	326.09		4,252.77
Totals	$15,000.00	$15,000.00	$60,000.00	$9,925.30	$27,101.98	$4,300.00	$56,066.70

Income for Supplement Expenditures:	
State Money Offsetting Federal Funds	$37,027.28
State Money for Station	11,318.42
Research Sales	7,721.00
	$56,066.70